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MANUFACTURING METHODS AND TECHNOLOGY (MM AND T) MEASURE FOR FAB--ETC(U)
JAN 77 S W KESSLER, A W MANNON, R E REED DAAB07-76-C-8120

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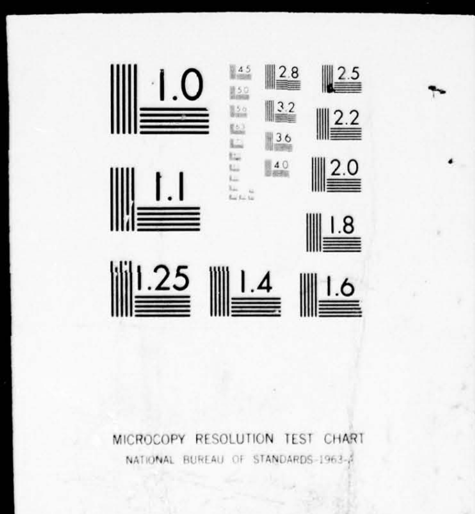

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First Quarterly Progress Report

MANUFACTURING METHODS AND TECHNOLOGY (MM&T) MEASURE FOR FABRICATION OF SILICON TRANSCALENT THYRISTOR

Period Covered:

27 September 1976 to 31 December 1976
Contract No. DAAB07-76-C-8120

Placed by:

U.S. Army Electronics Command
Production Division
Production Integration Branch
Fort Monmouth, New Jersey 07703

Contractor:

(1) RCA Corporation and
(3) SSD-Electro-Optics & Devices
New Holland Avenue
(2) Lancaster, ~~Pennsylvania 17604~~

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This project has been accomplished as part of the U.S. Army (Manufacturing and Technology) Program, which has as its objective the timely establishment of manufacturing processes, techniques or equipment to insure the efficient production of current or future defense programs.

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This First Quarterly Report describes the MM&TE program for Transcalent (heat-Pipe cooled) thyristors. A description of the device and the pertinent state-of-the-art at the inception of the program is included. Progress on redesigning for production is described for the device parts, processes and sub-assemblies. Also described are the problems encountered in the design of the high current, high voltage test equipment. Block diagrams of the

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20. (Continued)

circuit designs are included.

The present status includes the completion of the fixtures and the process specifications, the procurement of device parts and the initiation of sub-assembly work as well as the procurement of electronic components for the modification or fabrication of the electrical test equipment.

Plans for the next Quarter include completion of the engineering sample devices.

MANUFACTURING METHODS AND TECHNOLOGY (MM&T) MEASURE FOR FABRICATION OF SILICON TRANSCALENT THYRISTOR

First Quarterly Progress Report

Period Covered: 27 September 1976 to 31 December 1976

Object of Study: The objective of this manufacturing and methods technology measure is to establish the technology and capability to fabricate Silicon Transcalent Thyristors.

Contract No. DAAB07-76-C-8120

Prepared by:
S. W. Kessler
R. E. Reed

ABSTRACT

This first quarterly technical report on the MM&TE Contract DAAK07-76-C-8120 for Transcalent (Heat-Pipe cooled) Thyristors describes the device and the pertinent state-of-the-art at the inception of the program. Progress on redesigning the parts, sub-assemblies and processes for production is described. Also, the design problems encountered on the high current, high voltage test equipment are described and block diagrams of the circuit designs are enclosed.

Sample process data cards and test data record forms have been included as evidence of the preliminary production planning documentation that has been accomplished. Also included are details of the assembly sequence and the electrical/environmental tests to be performed.

Present status includes the completion of the fixtures and the process specifications, the procurement of most of the parts for the thyristor units and the initiation of sub-assembly fabrication and the process specifications, as well as the completion of the designs for the various test circuits, the ordering of components and the partially completed construction of the test equipment.

Plans for the next quarter include completion of the processing, fabrication and evaluation of the engineering sample thyristors, type J-15371. Delivery is scheduled for March 26, 1977.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS AND TABLES

PURPOSE

The purpose of this production engineering contract covers the attachment of heat-pipes to a semiconductor power device, silicon Transcalent Thyristor, Type J-15371, and subsequent pilot production of that device. This report covers the efforts performed by the contractor in the first three months to modify the device for production, establish process and fabrication methods as well as modify and construct the various types of test equipment required to adequately characterize the thyristor. Plans for future work are also presented, to help assure accomplishment of the purpose of the contract.

This contractual MM&TE program will establish the production techniques, establish quality control procedures and verify a pilot production capability for the J-15371 thyristor, conforming to the drawing attached to AMENDMENT 1 of SCS-477. Electrical, mechanical, and environmental inspections are a part of the program as well as extensive documentation requirements, per DD1423. No production facilities exist at the present time for this military type of solid-state power device, but production planning constitutes Step II of the contract. Thus, the time required to produce large quantities of the J-15371 will be reduced for either current military requirements or an emergency requirement.

The J-15371 thyristor is a 400 amperes RMS, forced air cooled solid-state power control device, utilizing integral heat-pipes for improved cooling efficiency, lighter weight and smaller size than the conventional devices with their external heat-sinks attached. Improved reliability is expected to result from these innovations. A blocking voltage capability of 800 volts minimum is a requirement of this contract. Original R&D efforts were conducted successfully by RCA under Contract No. DAAK02-69-C-0609, for MERADCOM, Ft. Belvoir, VA. Potential applications include power conditioning, power switching and motor speed control equipments.

GLOSSARY

All abbreviations, symbols and terms used in this report are consistent with the Electronics Command Technical Requirements SCS-477, dated 5 December 1974. This Technical Requirements document, in turn, references MIL-S-19500 for the abbreviations and symbols used therein except, as follows:

V_{GR} = Reverse Gate Voltage

I_{GR} = Reverse Gate Current

Note: The format used for this report is that specified in the DD 1423, namely, ECIPPR No. 15, Appendix C, augmented by MIL-STD-847A. Sub-section numbering is based on Appendix C.

NARRATIVE AND DATA

1. Device

a. Description of the Structure - The Transcalent Thyristor type J-15371 is designed to make maximum use of the integral heat-pipe thermal package developed previously for the Transcalent Rectifier.[1] A cross-section of the device is shown in Figure 1 with a heat-pipe attached to each side of the silicon chip. In operation, current is conducted to and from the silicon chip by the low inductance, high conductivity copper heat-pipes.[a] The studs at the ends of the heat-pipes are for fastening the high current leads to the device. The gate and auxiliary cathode leads are for attachment of the control signal to the thyristor.

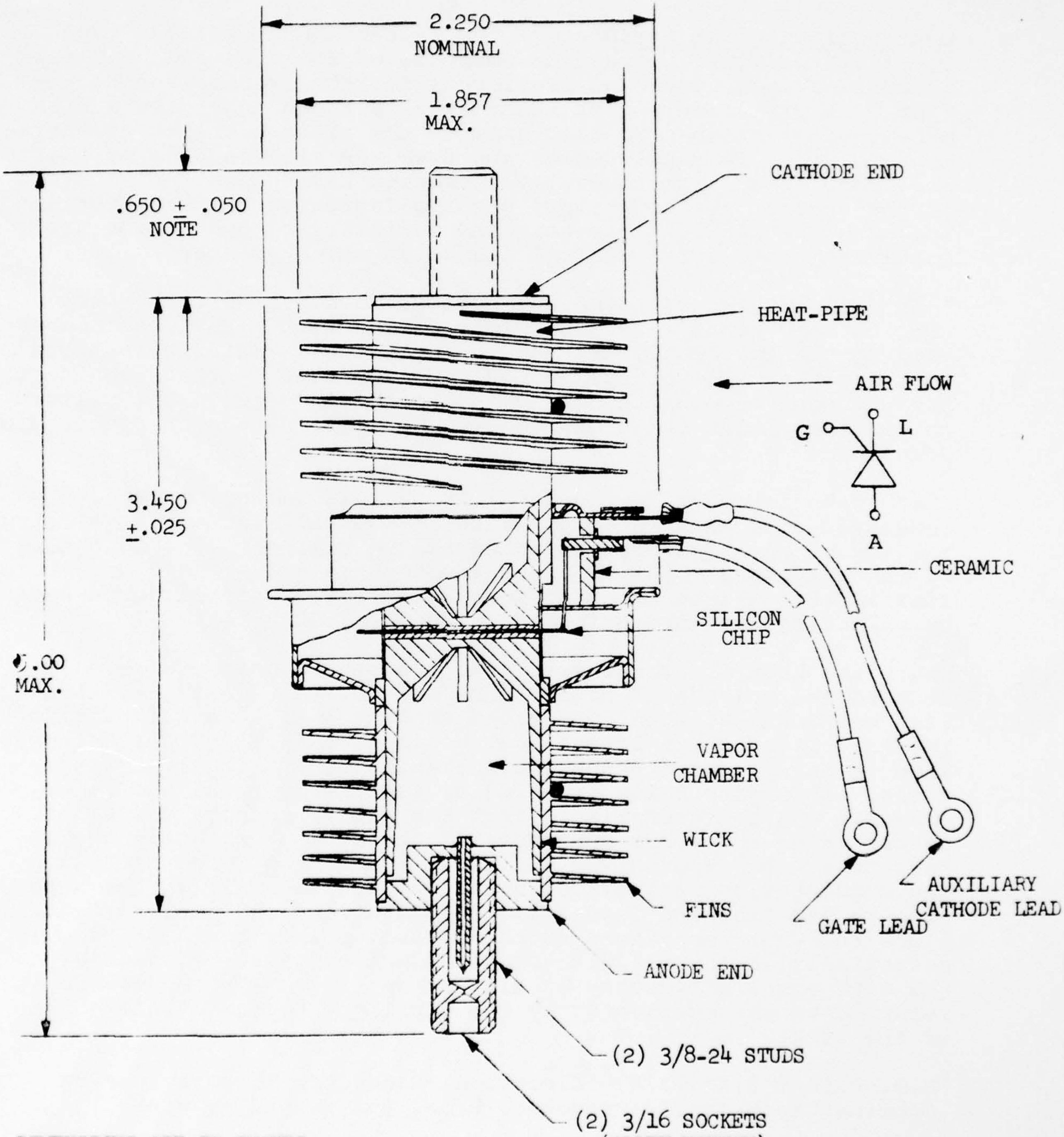
A ceramic insulator and metal envelope is constructed between the two heat-pipes. This envelope is the main structural member joining the two heat-pipes and prevents stress being transmitted to the weaker silicon chip. The envelope also contains an inert dry nitrogen atmosphere around the contoured edge of the silicon chip across which the high blocking voltages of the thyristor are developed.

Heat which is generated in the silicon chip during operation is conducted into the heat-pipes through the molybdenum disc closing the end of the heat-pipe adjacent to the silicon. The thickness of the molybdenum disc is optimized to have a minimum temperature rise in the silicon wafer during a single cycle of surge current by balancing the absorption and transfer of the heat.[b]

Next, the heat is transferred into the porous copper wick adjacent to the molybdenum disc. The pores of the wick are filled with water which, when evaporated, transfers heat to all parts of the heat-pipe by its latent heat of vaporization. Since the heat-pipe is an evacuated vessel, evaporation occurs at all temperatures, (including below freezing by sublimation) and the vapor pressure can be interpolated from the vapor pressure curves of water. When the vapor condenses at the coolest point in the heat-pipe, the vapor gives up its latent heat of vaporization. The condensation heat is conducted through the wall of the heat-pipe to the fins and dissipated to the air by the cooling fins. Since the vapor condenses at the coolest point, the heat-pipe is essentially isothermal with equal amounts of heat being dissipated with equal efficiency by all of the fins. The condensate is returned to the evaporator by the capillary forces of the pores of the wick.

[a]U.S. Patent 3,605,074, "Electrical Connector Assembly Having Cooling Capability", Freggens, R. A. and Harbaugh, W. E.

[1]Kessler, S. W., "Development of a 250 Ampere Transcalent Rectifier", Final Technical Report, June 1970, Contract DAAK02-69-C-0609.



DIMENSIONS ARE IN INCHES

● TEMPERATURE MEASUREMENT POINT

NOTE - THREADS - 0.550" MIN.

GATE LEAD LENGTH = 6" MIN.

Figure 1. Transcalent Thyristor Type J-15371 Cross-Section Drawing

The diffused silicon chip (one chip per wafer) was especially designed for the Transcalent Thyristor. It has a ring gate with the periphery of the cathode-to-gate junction beneath the face of the cathode heat-pipe.[c] A thin layer of oxide covering the junction prevents it from being shorted by the metallizing.[d] Thus, heat generated at the periphery of the cathode during a high rate of current change or di/dt is easily dissipated through the thin oxide and into the heat-pipe.

The silicon chip is diffused as a pnpn solid state device (silicon controlled rectifier) whose function is similar to a thyratron tube.[2] That is, the SCR acts like two transistors in series. When one of the base elements has no voltage applied, this transistor section is off. But when a voltage is applied to the base (gate), this transistor also starts the second and high current conduction occurs as avalanche breakdown ensues. Internal regenerative feedback maintains conduction until the anode voltage reverses or the current is interrupted by an external component.

Thus, the SCR/Thyristor functions as a high current, low loss, uni-directional switch.

This double-sided heat-pipe cooled thyristor is inherently rugged and has unique advantages. Applications experience with Transcalent devices has demonstrated their superiority over "hockey-puck" or "stud-mounted" devices, namely:

(1) There are no mechanical clamps fastening the device to the heat sink. ndustrial experience indicates that the clamping force relaxes through creep of copper and aluminum during the life of the "hockey-puck" thyristors. Inadequate cooling and lossy electrical contacts may result.

(2) Heat is extracted from both sides of the silicon with a minimum of material adjacent to the silicon. This arrangement produces a low-temperature gradient between the junction (which is limited in an SCR by the silicon characteristics to a maximum temperature of 125°C) and the ultimate heat sink.

[b] U.S. Patent 3,984,861, "Transcalent Semiconductor Device, etc.", Kessler, S. W.

[c] U.S. Patent 3,739,235, "Transcalent Semiconductor Device", Kessler, S. W.

[d] U.S. Patent 3,769,688, "Method of Making an Electrically Insulating Seal, etc.", Kessler, S. W.

[2] Mileaf, H., Editor-in-Chief, "Electronics Four", Hayden Book Co., Inc., Rochelle Park, NJ, 1967.

(3) The thickness and the thermal properties of materials adjacent to the silicon are optimized to absorb the transient surges of power that must be dissipated from the silicon if blocking and control characteristics are to be maintained.

(4) In operation the heat pipes are very tolerant to changes in power level because of their ability to respond quickly by evaporating an additional amount of working fluid. They exhibit a decreasing thermal resistance as the power level increases. This tolerance has been demonstrated by:

(a) The high surge-current rating for the Transcalent Thyristor.

(b) Operation of the device at 2000 Hz without derating its current for the additional dissipation accompanying the increased rate of recombination currents.

(c) Observing only a small increase in junction temperature when the device is operated under overload conditions.

(5) The assembly has a high resistance to fatigue failure because the materials adjacent to the silicon and bonded to it either nearly match the thermal expansion of the silicon or are designed to yield elastically. By comparison, the rubbing surfaces of a clamped device are subject to fretting and scoring.[3,4] As fretting debris accumulates between the clamped surfaces, the contact resistance between adjacent materials increases and alters their electrical and thermal impedances.

(6) Operation at higher ambient temperature is possible without current derating.

(7) Transcalent devices are of smaller size and lighter weight because of the greatly reduced temperature gradient between the junction and the fins. Also, all of the fins are equally effective in dissipating heat because the heat pipe is isothermal along its entire length.

[3] Comyn, R.H. and Fulani, C.W., "Fretting Corrosion", a literature survey, TR1169, Harry Diamond Labs, Army Materiel Command, Washington, DC, December 30, 1963.

[4] Comstock, W.R. and Locher, R.E., "High Current Diode and SCR Reliability Considerations", IEEE Power Electronics Specialist Conf. 1975, pp 224-233.

A developmental data sheet for the J-15371 is included on the next pages for reference purposes.

b,c. Defining the Problem Areas and Work Performed to Resolve the Problem

(1) Conversion of Design for Production - The Transcalent thyristor design achieved under R&D Contract No. DAAK02-69-C-0609 was described in the FTR, October, 1972. Subsequent refinements have been incorporated under contract N62269-73-C-0635 and by RCA-funded engineering projects. Additional engineering is being applied under the MM&TE program to convert the design to one even more suitable for production.

(a) Refined Gate Lead Feed-Through

Figure 2 of the J-15371 Developmental Data Sheet shows the outline and dimensions of the J-15371 device achieved under the R&D contract. A photograph of the R&D device is shown on the cover of this same data sheet.

The subsequent Navy procurement contract, noted above, involved a similar thyristor, but with 4¼-inches diameter fins for natural convection cooling, Transcalent device type J-15372. Both variants utilized a separate, small ceramic washer and a flexible tab feed-through for the gate terminal.

More recent design refinements involve relocating the gate lead, necessitating interchanging the anode and cathode ends of the J-15371. (Refer to Figure 1 of this report.) These variants; along with the continued use of the two-inches diameter Wolverine type tubing having integral, extruded cooling fins; are incorporated into the refined design of the J-15371 for the MM&TE production design.

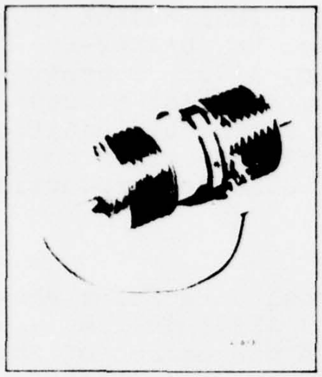
That is, the polarity of the MM&TE J-15371 variant is reversed from that of the R&D developmental type J-15371 shown in the data sheet. This change is to facilitate relocating the gate lead through the ceramic insulator, with adequate spacing from the weld. Occasionally a device of the old style was destroyed when the small gate feedthrough insulator broke or the closely-spaced tab shorted to the adjacent metal parts. The refined gate lead pin structures to be used in the MM&TE have been tensile tested with 97 pounds and found to be more than strong enough. Furthermore, it has been found that no handling failures or shorts have occurred with the pin type gate feed-through. The pin that was loaded with 97 pounds was pushed from the outside of the ceramic so that the braze and metallizing were in tension. Under this loading stress the braze did not fail but the pin was badly deformed to a mushroom shape.

RCA Electronic Components

Transcalent Device

Developmental Type

J15371



High-Current Transcalent Thyristor

RMS Forward Current Rating: 400 Amperes

- **Integral Heat Exchanger**
- **Lower Junction Temperature**
- **Interchangeable Polarity**
- **Simplified Replacement**
- **Forced Air Cooled**
- **Light Weight**
- **Low Volume**
- **Optimized Thermal Interfaces**

The RCA Dev. No.J15371 is a forced-air-cooled, silicon-controlled rectifier (thyristor) for high-current, military applications. New heat dissipation techniques are used to reduce the thermal impedance of the rectifier, thereby lowering the junction temperature. Heat pipes are directly bonded to the silicon wafer to eliminate all mechanical interfaces between the wafer and the integral cooling fins. Field replacement is simplified by the elimination of the need for separate clamped or threaded heat sinks. The reduced thermal impedance of the J15371 results in an increased average fin temperature and a consequent marked reduction in size and weight as compared with conventional rectifier/heat sink assemblies.

The J15371 can be useful in a variety of applications, such as solid-state switches, motor controllers and power conditioning equipment. The size and weight of the J15371, when related to its rated current, make it well suited for airborne, marine and portable/mobile equipment where compactness, light weight and high reliability are prime considerations.

The J15371 has a very low thermal impedance between the active silicon junction and the integral cooling fins (0.04° C/watt). The junction temperature, at full rated forward current, is typically only 15° C greater than the case temperature measured at the root of the cooling fins. This low thermal impedance can be used either to reduce the silicon temperature for enhanced reliability or to operate at full ratings in unusually high ambient air temperature (60° C).

The silicon wafer utilized in the J15371 features a peripheral gate geometry. The emitter-to-gate region, which is subject to intense thermal transients at the moment of current turn-on, is directly cooled by the integral heat pipes. This is made possible through the use of a thin, thermally conductive but electrically insulating layer between this critical junction and the heat pipe wick structure.

Maximum Ratings, Absolute-Maximum Values

Peak Forward or Reverse Blocking Voltage			See Note a
RMS Forward Current (180° Conduction Angle)	400	max.	A
Average Forward Current (180° Conduction Angle)	250	max. (See Figure 1)	A
Peak, Single-Cycle, Surge Forward Current (60 Hz)[b]	7000	max.	A
Peak, Sixty-Cycle, Surge Forward Current (60 Hz)	2000	max.	A
Maximum Rate of Rise of Anode Current During Turn-On Interval (Switch from 800 V)	1000	max.	A/μ sec
Maximum Rate of Rise of Forward Blocking Voltage	200	max.	V/μ sec
I^2T for Fusing (At 8.3 m sec) (Max. Value at 25°C)	200,000	max.	A^2 sec
Gate Current, DC (At 1.0 V DC Typical)	500	max.	mA

General Data

Thermal Impedance[c]		
Junction to case	0.04	$^{\circ}$C/W
Junction to air (with 150 cfm air thru fins)	0.16	$^{\circ}$C/W
Cooling Air Flow Requirements[d]	150	cfm
	0.4	in H_2O
Typical Forward Voltage Drop (At 250 A Average Forward Current, 60 Hz)	1.5	V
Operating Attitude		Any
Weight (Approx.)	10	oz

For further information or application assistance on this device, contact your RCA Sales Representative or write Power Tube Marketing, RCA, Lancaster, PA 17604

Developmental type devices or materials are intended for engineering evaluation. The type designation and data are subject to change, unless otherwise arranged. No obligations are assumed for notice of change or future manufacture of these devices or materials.

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Supersedes 4-73 J15371

General Data (Cont'd)

Dimensions (See Figure 2):

Length (overall, maximum)	5.0	in
Diameter (maximum)	1.94	in
Operating Temperature	−20 to +125	°C
Storage Temperature	−55 to +135	°C
Holding Current (At 6.0 V DC)	100	mA
Operating Frequency (Maximum)	2000	Hz
Typical Turn-Off Time	50	μsec

Notes

a Maximum voltage characteristic is available on a selective basis up to a value of approximately 1200 volts. Typical values are as follows:

Type No.	Blocking Voltage
J15371G	500 V peak
J15371K	800 V peak
J15371L	1000 V peak
J15371M	1200 V peak

b The peak surge current rating may be applied to the device in either the operating or the nonoperating state. However, the frequency of occurence is limited by the power dissipation capability of the device to return to thermal equilibrium. The limit on this PRF is twelve pulses per minute for single cycle surges and one series per minute for 60 cycle surges.

c Thermal impedance displays a transient variation but obtains equilibrium within the specified steady-state value in less than three minutes.

d The maximum air flow requirements are based on the limiting conditions of the device. The air flow specifications were developed under laboratory conditions of sea level and 25° C. Compensation is necessary for operation at altitude or in ambient air at higher temperature. For further information see Application Note AN-4869 "Application Guide for Forced-Air-Cooling RCA Power Tubes".

Operating Considerations

Because it is designed for the silicon chip to operate at temperatures close to the envelope temperature, the J15371 will operate in environments of higher ambient temperatures than conventional devices.

> **Warning — Personal Safety Precautions**
> *Electrical Shock* — Operating voltages applied to this device present a shock hazard. Appropriate precautions should be taken.

Electrical Shock

Care must be exercised to insure against accidental contact with these high voltages. All high voltage circuit enclosures should be interlocked to break the supply voltage circuit when access is required.

Mounting

The J15371 should be mounted in the output end of the cooling duct by securing one end to a fixed bulk-head, busbar plate. The other end of the rectifier should be connected by means of a flexible lead heavy enough to carry the rated current.

The face of the lug is fastened against the end of the heat pipe. The stud should not be used to carry current.

The J15371 is a sturdy component. However, it can be damaged it the nuts fastening the leads to the unit are torqued through the body of the device. It is recommended that the stud be held stationary with an "Allen" wrench while tightening the nut.

For further information on Silicon Rectifiers, write RCA Commercial Engineering, Harrison, NJ 07029. Request Technical Series Booklet SP51 or SC15.

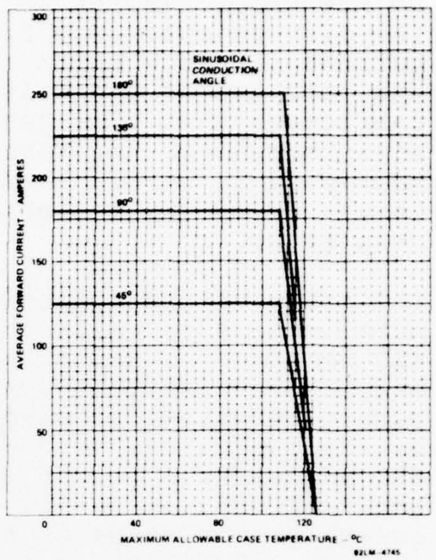
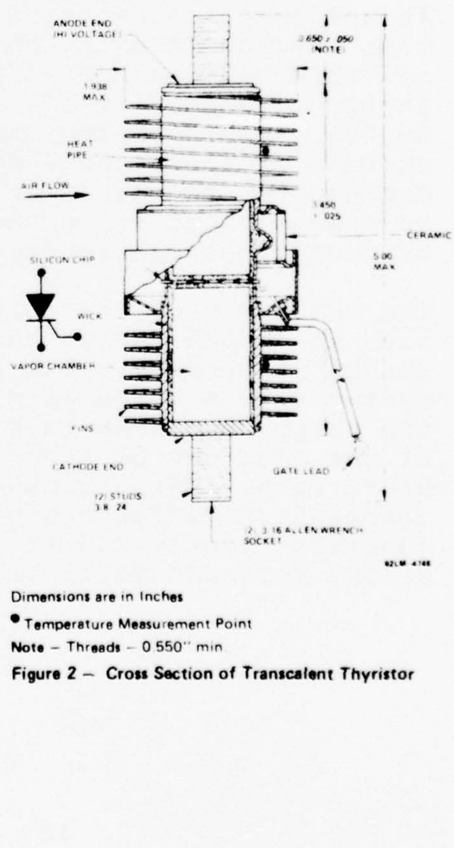


Figure 1 — Forward Current Rating



Dimensions are in Inches

• Temperature Measurement Point

Note – Threads – 0.550" min

Figure 2 — Cross Section of Transcalent Thyristor

(b) Pre-Fabricated Heat-Pipes

The two heat-pipes used for double-sided cooling of the thyristor chip have been redesigned by the addition of a thin molybdenum diaphram or disc adjacent to the chip. (Refer to Figure 2.) The thickness of the disc is optimized for the heat-sinking of high current surges without burn-out. Besides this advantage, the use of the molybdenum disc produces a prefabricated heat-pipe assembly having the following advantages over the former method of constructing the heat-pipe in which the open end of the heat-pipe was vacuum sealed by soldering the metallized silicon chip to it.

The joint of the thinned-end of the heat-pipe to the metallized silicon is the joint that was used in the R&D contract. Vacuum leaks occurred frequently. The molybdenum disc that now seals to the copper heat-pipe eliminates the need for a vacuum joint to the silicon. The new metal-to-metal joint is very strong and maintains a reliable vacuum seal. By transferring the leak check criteria to this earlier stage of sub-assembly, the value of the parts involved is greatly reduced. Batch or continuous furnace pre-brazing of the heat-pipe sub-assemblies is also made possible as a further cost reduction.

It has been demonstrated by an RCA thermal fatigue test that thyristors using the molybdenum discs are very reliable and the heat-pipes are almost immune to thermal fatigue. This test of a J-15372 has been cycled over 69,000 times from ten minutes "On" at the full rated current of 400 amperes RMS, to ten minutes "Off". This corresponds to more than 11,500 hours of operating on-time without any changes in the device's electrical or mechanical characteristics.

The thickness of the molybdenum disc has been optimized to absorb the instantaneous power losses during surges of current. The peak temperature of the junction during such a surge is plotted versus the thickness of the molybdenum disc in Figure 3. The optimum thickness of the disc can be seen to be approximately 0.025 to 0.030 inch. This thickness of molybdenum increases the temperature difference between the heat-pipe and the junction by only 2.5 to 3.0°C, under steady-state operation, but adds multiple surge capability.

REVISIONS	
AP. BY	0
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DIMENSIONS ARE IN INCHES AND INCLUDE THICKNESS OF PLATING. DO NOT SCALE DRAWING. ALL EXTERNAL THREADS TO BE CLASS 2A BEFORE PLATING AND NOT GREATER THAN THE MAXIMUM SIZE OF CLASS 3A AFTER PLATING. ALL INTERNAL THREADS TO BE CLASS 2B UNLESS OTHERWISE SPECIFIED. ALL THREADS TO BE UNIFIED STANDARD SCREW THREAD SERIES UNLESS OTHERWISE SPECIFIED.

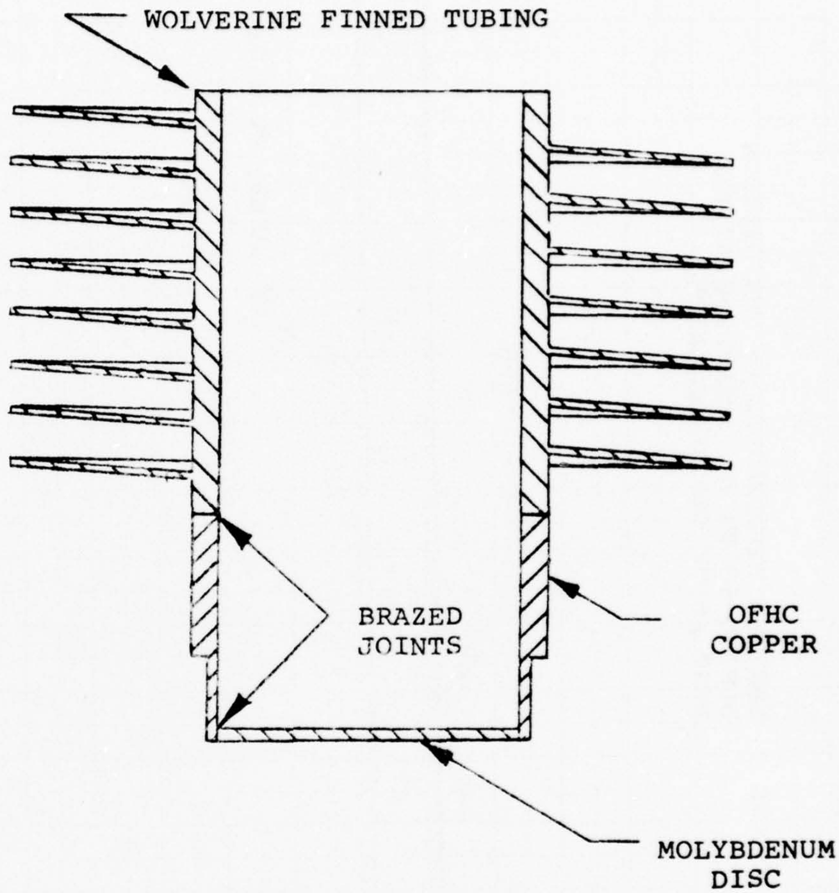


FIGURE 2

TOLERANCES AND WORKMANSHIP REQUIREMENTS NOT SPECIFIED ON THIS DRAWING SHALL CONFORM TO SPECIFICATION 93650.

BASIC DIMENSIONS	2 PLACE DECIMALS	3 PLACE DECIMALS
UP THRU 6		
6 THRU 24		
ABOVE 24		
ANGULAR DIMENSIONS		

RCA CORPORATION

CATHODE SUB-ASSLY. J15371

DRAWN BY W. T. BURKINS

DESIGNED BY S. W. KESSLER

CHECKED BY

COMMODITY CODE

A SIZE 302 5242

CODE IDENT NO. 49671 SHEET CONT'D ON SH

RCA 414-2 REV. 2 2-73 PRINTED IN U.S.A.

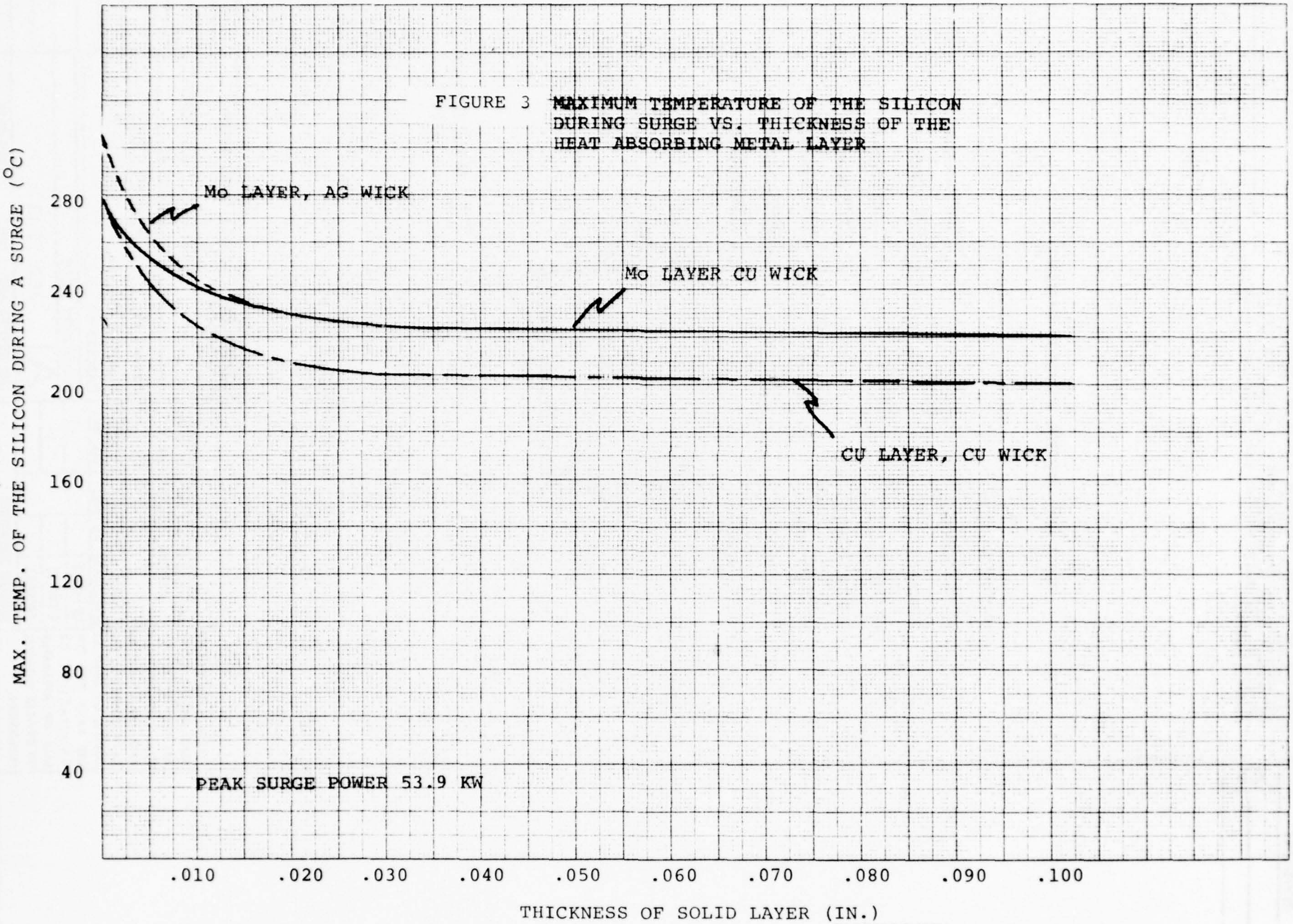


FIGURE 3 MAXIMUM TEMPERATURE OF THE SILICON DURING SURGE VS. THICKNESS OF THE HEAT ABSORBING METAL LAYER

(c) Wolverine Finned Tubing Assembly

Wolverine extruded finned tubing is made from phosphorus deoxidized copper. The phosphorus lowers the melting point of the gold copper brazing alloy by forming a ternary alloy. In the molten state, the phosphorus evaporates rapidly, creating blisters or pits adjacent to the braze joint used to braze the molybdenum disc into the heat-pipe. Thin sections of copper are particularly prone to this problem and vacuum-tight joints cannot be made reliably. To solve this problem, the section of the heat-pipe having the thinned-strain isolation section was changed to OFHC (oxygen-free high conductivity) copper. (Refer to Figure 2.) The successful brazing of these joints is discussed below under "Process, Equipment and Tooling." Note that a butt joint is utilized between the two copper parts to reduce machining time. A self-jigging step was used on each part in the original design of this sub-assembly.

(d) Heat-Pipe Wick Improvement

This RCA-proprietary improvement is being incorporated in the devices fabricated under the MM&TE program. Details are excluded from this report under paragraph J.41, "Limited Rights Data", of the contract. Authorized personnel may refer to Technical Proposal RCA-DP-6024, 25 March 1976 (use or disclosure restricted) for details of this high strength wick improvement.

(e) Reduced Material and Assembly Costs

The design of the MM&TE J-15371 incorporates other cost reductions which RCA has made in the parts design. (Refer to Figure 1.) The weld ring which surrounds the silicon wafer and the flange which joins it to the heat-pipe are made of less costly cold rolled steel. In the original R&D design, these parts were made of Kovar, an iron alloy which contains nickel and cobalt, expensive alloying elements.

The dissimilar expansions of the cold rolled steel and Kovar seal ring (which must still be attached to the ceramic insulator) is compensated by the radial flange weld configuration. A cylindrical joint, as used previously between these two parts, would open up as it is heated in welding because of the larger expansion rate of the steel. The diameter of the weld ring has also been made slightly larger so that it may be slipped over the heat-pipes after joining the heat-pipes to the silicon chip, thus simplifying the edge passivation of the chip and simplifying the assembly.

Some new parts are also now designed to eliminate the costs of self-jigging steps or diameters and transfer the jigging to reusable brazing fixtures. Reduced material, parts and assembly costs have resulted.

(f) Improved dv/dt Capability

Another change which has been made in the diffusion process of the silicon chip is to increase the number of shorting dots employed in the cathode pattern. The reason for this pattern change is that an induced current flows in the gate layer when there is a rapid rate of change of blocking voltage (dv/dt). The p-base gate layer has a relatively high resistance because it is lightly doped, thus when the voltage gradient reaches the range of 0.25 to 0.6 volt, depending on junction temperature, the thyristor may be accidently gated into conduction. The smaller the resistance, the greater is the rate of change which the thyristor can experience without being accidently gated.

This resistance can be decreased by evenly distributing a large number of shorting dots throughout all of the cathode area, to the gate layer. In the R&D contract there was only one 0.030 inch diameter shorting dot in the center of the cathode contact area. This dot was 0.385 inch from the periphery of the gate to emitter junction.

As described above, additional shorting dots are believed to be needed to meet the dv/dt specification of the MM&TE program. With only one dot on the devices fabricated under the R&D contract, the dv/dt test at 125°C had to be performed with a one ohm resistor shunting the gate-to-emitter terminals. This resistor is not permitted under the MM&TE contract although the resistor performs the same function as the shorting dots. Having the dots evenly distributed over all of the emitter area is a more effective solution.

RCA has designed a multiple shorting dot pattern for the J-15371 cathode. Drawing No. 3025261R1 shows this revised shorting dot pattern. Note that dots are very small and arranged to intersect all possible current paths. The resistance of the p-base layer of the chip was calculated from the following equation:

$$R = \frac{\rho_s}{2\pi} \ln \left(\frac{d_2}{d_1}\right) \qquad (1)$$

where: R is the resistance in ohms,
ρ_s is the sheet resistance of the p-base in ohms per square,
d_2 is the emitter diameter, and
d_1 is the diameter of the outer-most ring of shorting dots.

If ρ_s is 1000 ohms per square, R is 6.56 ohms and if the gate voltage V_{GT} is 0.6 volts, the device should trigger at a gate current of I_{GT} = 92 mA. This is well within the 500 mA limit of the MM&TE contract. Any conductive pin holes in the oxide insulation, noted in Section a above, will increase the observed gate current.

The effectiveness of the shorting dots can be estimated. The capacitance of a junction with a concentration of $C_o = 10^{14}$ atoms/cc is 4.5×10^{-4} pf/mil^2. One dot affects an area of a circle of a diameter equal to the distance between two adjacent dots. Induced currents in the base can be calculated.

$$i = C \, {}^{dv}/_{dt} \tag{2}$$

where: dv/dt is specified as 200 v/μs, and
C is the capacitance of the affected area in farads.

Substitution yields a current of 1.13×10^{-7} mA which is less than the specified leakage current for the junction. It can be concluded that the device will withstand a voltage rate of change of 200 v/μs when tested because the induced current is far less than the gate current required to trigger the SCR into conduction.

A set of photo-masks of this improved configuration was procured and used for wafers in pro. The first group of such wafers processed had only one-half of the outermost ring of shorting dots covered by the cathode metallizing. Since the dots were effectively contacted by this much metallizing, the wafers are expected to operate effectively in improving the electrical characteristics of the thyristor.

However, for future wafers the cathode diameter on the masks will be revised to encompass all of the shorting dots. Quotations are being secured for the latter set of masks which will require the computer generation of a metallic contact pattern of 0.010 inch larger diameter.

d. <u>Conclusions</u>

The device described above along with the design refinements incorporated or planned is expected to produce a J-15371 device to meet the specifications and tests of SCS-477.

e. <u>Drawings</u>

Drawings of the piece parts and sub-assemblies are included in the Appendix. The drawings of the complete device are shown in Figure 1 and in Drawing No. 3025268 in Appendix A.

2. Process, Equipment and Tooling

a. Purpose of Each Step

(1) Device Processing and Tooling

Figure 4, Engineering drawing No. 3025577, shows the flow of parts through the various assembly steps and a descriptive title is listed for each operation. Also shown are the subassembly drawings and the fixture drawing numbers for each operation. On each subassembly drawing (in Appendix A) is an outline of the process and the important parameters which must be controlled. The capacity at each operation is discussed in a succeeding section.

Flow process cards are also used to record and control the flow of parts through the process. Examples of these cards are shown in Figures 5 and 6. The form TL 4825 cards in Figure 5 will be used to record the metallizing and electrical test data of each lot of wafers (chips). The cards in Figure 6, Form TL 4827, will be used to record the data in fabricating the heat-pipes, ceramics and their assemblies into a finished device, ready for exhaust processing.

(2) Electrical and Environmental Test Equipment

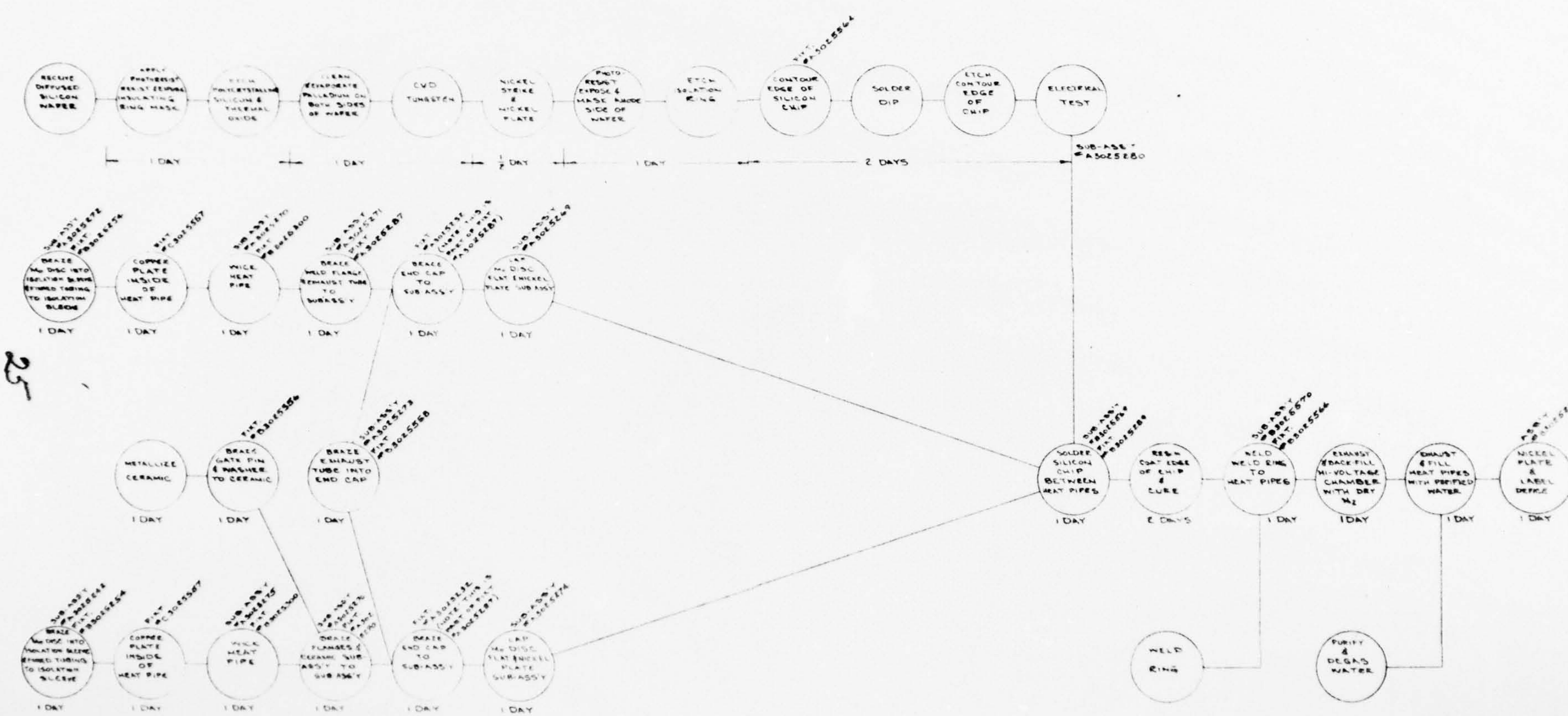
The flow chart of the electrical and environmental testing sequence is given in Figure 7, Drawing No. 3025578. The name of the test is given as well as the special conditions and the MIL-STD-750B method number. Also, listed are the sampling percentages for the pilot run. Long term tests have the time interval indicated in the figure.

Test Data Record Forms are included in Figure 8a, b, c and d. These forms will be used to record the actual test results on the various units after exhaust processing is completed.

b,c. Problem Areas and Work to Resolve Problems

(1) Device Processing and Tooling

The following fabrication processes are known to limit RCA's production capabilities for Transcalent thyristors because the operations involve a large amount of operator skill and time or because of limited equipment throughout. The operator's time can be reduced by introducing automatic or semiautomatic operations and



ASSEMBLY DETAIL

Dwg. No. 3025577

Figure 5. Thyristor Chip Process Data Cards

Transcalent Thyristor Process Data

Diffusion Group # ________ **Date** ________

	Date	Oper.	# Wafers In	# Wafers Out
1. Clean, Hot Xylene				
2. SC180 Mask D				
3. Fan Etch Time Sec				
4. (B)HF Etch Time Sec				
5. J100, J100 Hot Xylene, Vap. Degr., Alcohol Rinse, Dry				
6. Emitter V/I				
7. Gate V/I				
8. Collector V/I				
9. Wafer Weight				
10. SC1, R, SC2, R				
11. B(HF) Etch Time				
12. Rinse, Dry				
13. Evap. Palladium Wt.				
14. CVD Tungsten Wt.				
15. Etch Tungsten				
16. Nickel Strike & Plate				
17. Boil Xylene				
18. SC180 Emitter				
19. Mask E				
20. Tape Collector				
21. Etch Nickel				
22. Etch Tungsten				
23. Etch Poly Silicon				
24. J100, J100 Hot Xylene, Vap. Degr., Alcohol Rinse, Dry				
25. Contour Angles				
26. Solder Dip				
27. Hot Naoh, Clean, Naoh 2 Dips 10 Sec. Each				
28. Wax Both Sides				
29. Fan Etch Junction				
30. Vap. Degr., Etch, Rinse				
31. Electrical Test — Record Data on Back				

TL 4825 12 76

I_{SHUNT}	ma	
I_{GT}	ma	
V_{RBOM}	1 ma	
V_{RBOM}	.1 ma	
V_{FBOM}	1 ma	
V_{FBOM}	.1 ma	
Wafer No.		

Figure 6. Thyristor Assembly Process Data Cards

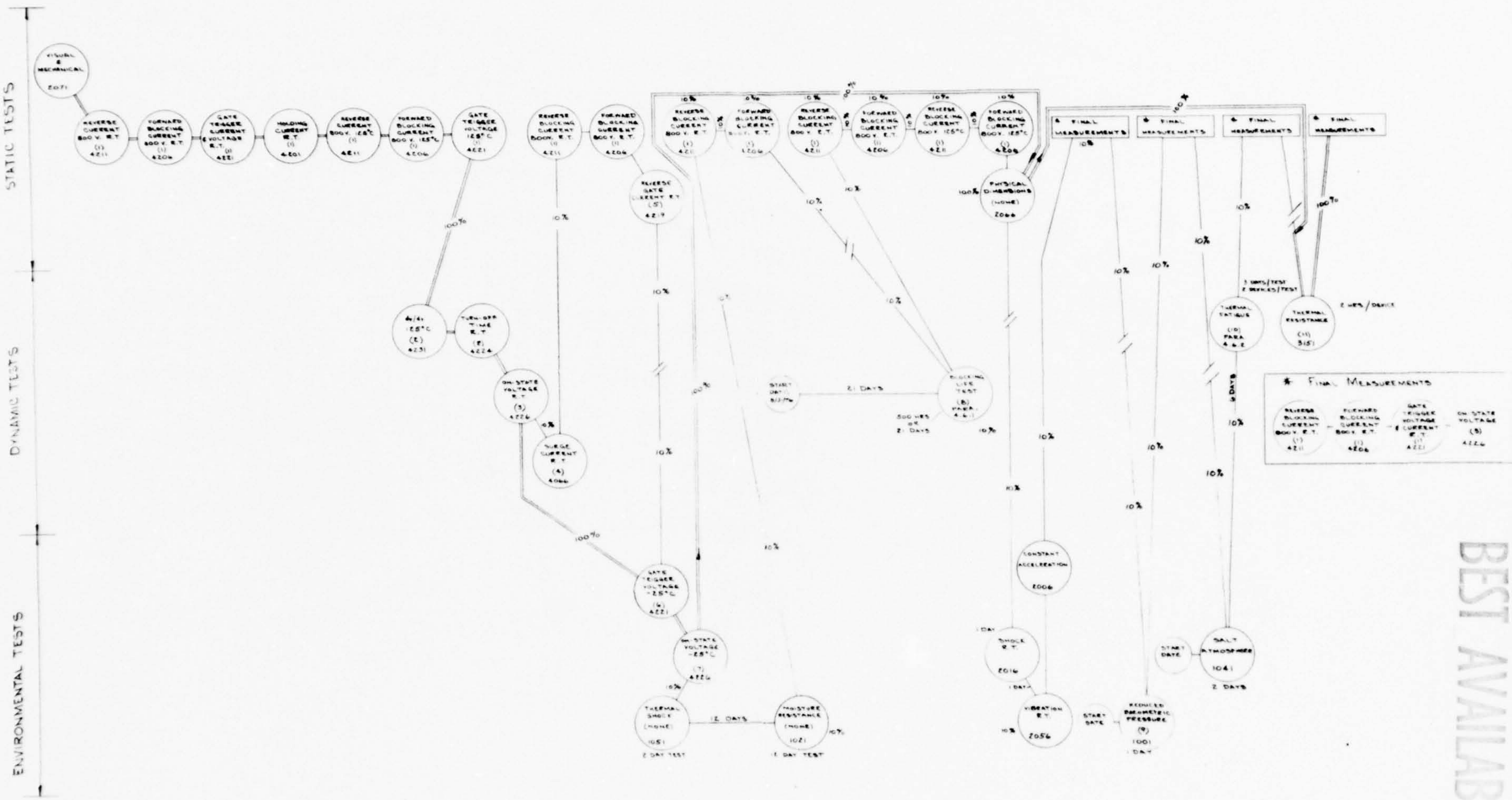
J15371A Transcalent Thyristor

	Fixt. 302-	Date	Oper.	# Units In	# Units Out
Anode Heat Pipe:					
1. Braze Body Sub-Assly. 1020°C, 15 min., H_2	5254				
2. Copper Plate Inside HP	5557				
3. Wick HP 975°C, 25 min., H_2	5551				
4. Braze Flange & Exh. Tube/HP 830°C, 15 min., H_2	5287				
5. Braze End Cap in HP 760°C, 20 min., H_2	5232				
6. Helium Leak Test					
7. Lap					
8. Nickel Plate & Insp.					
9. Check Flatness of Moly Disc & Flatten					
Cathode Heat Pipe:					
10. Braze Body Sub-Assy. 1020°C, 15 min., H_2	5254				
11. Copper Plate Inside HP SCH. C1	5557				
12. Wick HP 975°C, 25 min., H_2	5551				
13. Braze Gate Lead/Ceramic 1020°C, 15 min., H_2	5556				
14. Helium Leak Test					
15. Braze Flange & Ceramic/HP 830°C, 15/15 min., H_2	5290				
16. Braze End Cap/HP 760°C, 15/20 min., H_2	5232				
17. Helium Leak Test					
18. Lap					
19. Nickel Plate & Insp.					
20. Check Flatness of Moly Disc & Flatten					
End Cap Sub-Assembly:					
21. Braze Exhaust Tube 830°C, 15 min., H_2	5558				
Final Assembly:					
22. Solder HP's/Si Wafer 395°C, 5 min., H_2=3 Torr	5289				
23. Resin Coat Edge of Silicon					

TL 4827 12/76

J15371A Transcalent Thyristor

	Fixt. 302-	Date	Oper.	# Units In	# Units Out
24. Weld	5565				
25. Exh., Bake, Back Fill HI Volt. Chamber-Dry N_2					
26. Distill H_2O					
27. Fill Wick With H_2O					
28. Finish, Leads, Studs & Nuts					
29. Electrical Test					
30. Label					
31. Package					
32. Quality Assurance Verification					
Parts Preparation					
Ceramic:					
Metalize					
Plate Sch 13-1-2MP PG6200J					
Moly Disc (Before Brazing) Nickel Plate Sch N-1	5203				
Vapor Degrease: (Before Assembly Usage)					
Exhaust Tube	5207				
Anode Strain Isolation Sleeve	5248				
End Cap	5212				
Finned Tubing	5247				
Anode Weld Flange	5260				
Cathode Strain Isolation Sleeve	5242				
Exhaust Tube	5283				
Weld Ring	5258				
Vapor Degrease, Fire 900°C, 30 min., Line H_2 & Fire 1100°C, 20 min., Line H_2 **(Before Assy. Usage)**					
Gate Pin	5278				
Gate Pin Washer	5279				
Cathode Weld Flange	5259				
Cathode Flange	5225				



ELECTRICAL/ENVIRONMENTAL TESTS DETAIL

NOTES:-
1. 100% TESTING IS CONNECTED BY A DOUBLE FLOW LINE
2. 10% TESTING IS CONNECTED BY A SINGLE FLOW LINE

DWG. No. 3025578

ITEM: SILICON TRANSCALENT THYRISTOR, J15371 | CONTRACT: DAA B07-76-C-8120 |

SPEC: SCS-477 5 DECEMBER 1974 & | MFR: RCA (EO&D) LANCASTER, PA.

AMENDMENT - 1 31 AUGUST 1976 | BUYER: COMM.SYS.PROCUREMENT BRANCH (USAECOM),FT.MONMOUTH,N

GROUP	A											
SUBGROUP	1	2	2	4	4	4	3	3	3	3	4	4
NO. UNITS TESTED	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
TEST	Visual & Mech.	Reverse Current	Forward Blocking	Gate Trig.V	Gate Trig.I	Holding Current	Reverse Current	Forward Block'g	Gate Trig.V	Exp.Rate V Rise	Turn-off Time	On State Voltage
MIL-STD-750 METHOD	2071	4211	4206	4221	4221	4201	4211	4206	4221	4231	4224	4226
TEST CONDITION	Visual Inspt.	25°C →					125°C →				25°C	
SYMBOL	-	i_{RBOM}	i_{FBOM}	V_{GT}	I_{GT}	I_H	i_{RBOM}	i_{FBOM}	V_{GT}	dv/dt	t off	V_{FM}
MAX.	-	15mA	15mA	5Vdc	500mAdc	500mAdc	60mA	60mA	5.0Vdc		150μs	2.0V
MIN.	-									200V/μs		
UNIT NO. 197_ Date Tested	A C C / R E J											

Note: Details of test conditions are given in spec.

Figure 8a. Test Data Record Forms

CONTR'S. TYPE: J15371 DATE TEST COMPLETED:

MFR'S. TYPE: J15371 DATE TEST BEGUN: FR. TO

B													
1	1. Final Measurements			2			3. Final Meas.		4. Final Measurements				
10%	10%	10%	10%	100%	100%	100%	10%	10%	10%	10%	10%	10%	
Surge Current	Reverse Current	Forward Block'g	Rev. Gate Current	Gate Trig. V	Gate Trig. I	On-state Volt.	Temp. Moist	Cycle & Resist	Blocking per para.	Voltage 4.6.1	Life	Test	
4066	4211	4206	4219	4221	4221	4226	1051	1021	4211	4206	4211	4206	
-25°C	25°C →			-25°C →			4211	4206 →	25°C →		125°C →		{case temp, T_C
I_{FM}	i_{RBOM} 15mA	i_{FBOM} 15mA	I_{GR} 1.0Adc	V_{GT} 10Vdc	I_{GT} 1000 mAdc	V_{FM} 2.3V	i_{RBOM} 15mA	i_{FBOM} 15mA	i_{RBOM} 15mA	i_{FBOM} 15mA	i_{RBOM} 60mA	i_{FBOM} 60mA	
10 Surges													

Figure 8b.

GROUP	C									
SUBGROUP	1					2.Final Measurements				
NO.UNITS TESTED	100%	100%	100%	100%	100%	10%	10%	10%	10%	10%
TEST	Physical Dimens.					Shock,	Vibration,	Constant	Accel.	
MIL-STD-750 METHOD	2066					2016	2056	2006		
TEST CONDITION	Figure 1					4211	4206	4221	4221	4226
SYMBOL	A	B	C	D	E	i_{RBOM}	i_{FBOM}	V_{GT}	I_{GT}	V_{FM}
MAX.	5.00"	3.475"	0.700"	1.938"		20mA	20mA	5Vdc	500mAdc	2.5V
MIN.		3.425"	0.600"		6.00"					
UNIT NO.								For information only - Not a spec. requirement		

Figure 8c.

3.Final Measurements					4.Final Measurements					5
10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	100%
Reduced Barometric Pressure					Salt Atmosphere, Thermal Fatig.					Thermal Resistance
1001					1041	para. 4.6.2				3151
4211	4206	4221	4221	4226	4211	4206	4221	4221	4226	
i_{RBOM} 20mA	i_{FBOM} 20mA	V_{GT} 5Vdc	I_{GT} 500mAdc	V_{FM} 2.5V	i_{RBOM} 20mA	i_{FBOM} 20mA	V_{GT} 5Vdc	I_{GT} 500mAdc	V_{FM} 2.5V	θ_{j-c} 0.15°C/Watt

Figure 8d.

by increasing the number of units per operation. Each problem process will be discussed in the sequence of occurrence in the fabrication.

(a) Contouring and Etching of the Chip

The diffused and metallized wafers are cut to size with a dental sand blaster and contoured while cemented on a mandrel, Dwg. No. 3025564.# After contouring, they usually are removed from the mandrel and solder dipped, the metal surfaces are painted with wax, the contoured edge is etched and the wafer is tested for forward and reverse blocking voltages.

The contouring and etching of the silicon chip is a labor intense operation because two operations must be done under a microscope employing the skills of the unaided operator's hand. The operations are positioning the wafer on the mandrel while the mounting wax is hot, and painting of the wax up onto the edge of the contour to protect the metallizing during the nitric-hydrofluoric acids etch. The latter operation may have to be repeated if the chip fails the high voltage test in the curve tracer.

To reduce the amount of labor involved in this operation, it is proposed that the etching and testing be done while the wafer is still on the mandrel. To protect the metallizing, a wax would be spun on the wafer in the same way as photoresist is applied and then the contour cut would be made through the wax onto the wafer. To protect the mandrels from the acids, it is proposed that they be made of notably corrosive resistant alloys. Electrical contact to the metallizing during testing would be made by using a sharp electrode which could penetrate the wax coating at one point.

Corrosion tests in FAN etches were conducted on Hastelloy C-276 and G alloys as well as 316 stainless steel. It was noted that the resistance to corrosion was greatest with increasing amounts of chromium. For this reason, a sample of 310 stainless steel having 25 percent chromium was ordered for testing. Once a material is selected, it will be used to fabricate the mandrels on which the wafers are contoured. By using a mandrel resistant to corrosion by FAN etches, it will be possible to etch the wafers on the mandrel.

#Tool, fixture and mask drawings are included in Appendix B.

The corrosion tests were concluded, including a sample of 310 stainless steel. The higher chromium content of the 310 stainless steel reduced the corrosion rate, as expected, and made it unnecessary to purchase a more expensive super alloy.

The results are summarized, as follows:

Etch	Material	Corrosion Rate
Fan Etch: 1 part HF,	Hastelloy C-276	0.353 mg/cm^2/hr.
2 parts acetic acid, &	Hastelloy G	.068
2 parts HNO_3	316 stainless steel	.168
	310 stainless steel	.075
10% HF &	Hastelloy C-276	0.910 mg/cm^2/hr.
90% HNO_3	Hastelloy G	.220
	316 stainless steel	.371
	310 stainless steel	.113

In earlier tests of Hastelloy G a rate as great as 0.159 mg/cm^2/hr. (compared to 0.068 in the table) had been observed in the FAN etch. Thus, the type 310 stainless steel has been selected as the material for contouring mandrels that are resistant to the etchants used to remove the mechanical damage from the silicon edges.

(b) Soldering of Chip to Heat-Pipes

The method of solder dipping the chip and soldering it to the heat-pipes was discussed above. This R&D process requires a great deal of skill in that the alignment of the three parts is made by eye, that is, the operator must align the two heat-pipes such that their cylindrical surfaces are concentric with each other and with the isolation ring etched on the cathode side of the chip. This is especially difficult because the solder on the dipped chip is crowned, being thicker in one area than another, and the emitter heat-pipe often tilts.

To de-skill this assembly operation, it was proposed that a two-part demountable fixture be designed for fixturing the parts and that solder preforms be tried instead of dipping. The fixture would be split so that it can be easily removed from the assembly and would have three concentric surfaces for positioning the three parts. The two smallest concentric surfaces would fixture the heat-pipes. The center cylindrical surface would be slightly larger than the largest chip. With these dimensions, the small space between the fixture and the edge of the wafer could be used to gauge the alignment of the chip and the surface of the fixture would not come in contact with the high voltage contoured surface of the chip.

In developing this operation, there will be a need to explore the soldering schedule. If solder preforms are used, and are soldered in a batch of 10 to 12, it may be desirable to introduce a soak time in the soldering schedule or to pre-wet a surface with solder prior to assembling. For example, preforms could be melted onto the ends of the heat-pipes prior to making the assembly.

Effort in this area will be applied during the next quarter.

(c) Alignment of the Wafer

Silicon wafers used during the development program were round and had to be closely examined by the operator to determine their rotational orientation before placing them in the mask aligner. For this MM&TE program, it was proposed to order silicon crystal with a flat ground onto the surface of the ingot before it is sliced into wafers. In this way, each wafer would have an orientation flat to index the rotation. Close inspection prior to placing them on the aligner will thus be eliminated.

However, it has been determined that having an alignment flat on each silicon wafer will interfere with sealing the edge of wafer in a teflon fixture for an etch back operation. Thus, it was decided to change one of the existing alignment dots to an easily recognizable symbol. The symbol is two rectangles positioned along their diagonals as shown in Dwg. No. 3025264R1. This symbol is easily seen and the operator can orient the wafer with respect to it. The rings shown on the drawing

are used to position the wafer with the mask through the split optical system in the mask aligner.

As a further cost savings, wafers will also be identified as batches or lots rather than as individaul wafers and the identity of each batch will be maintained throughout its processing. During the development program, it was attempted to identify each wafer separately and considerable time was spent in tracing and maintaining this identity.

(d) Silicon Wafer Diffusion

The specifications for the starting silicon wafer have been standardized in RCA's Engineering Specification 13-1-1M; L-301. This standard specifies that the crystals have a float zone with a resistivity 50-60 ohm-centimeters with a minimum carrier life time of 100 microseconds and a dislocation density of less than 500 per square centimeter. The wafers are sliced and lapped at RCA-Mountaintop, PA, to a thickness of 0.015 inch prior to diffusion.

Diffused wafers are being obtained from two sources. The one vendor, PPC Products, Eatontown, NJ, has not been successful thus far in producing operable wafers. The leakage currents of their first group of wafers were excessive and in diffusing the second group of wafers, they apparently over-diffused the cathode/emitters. There are additional samples being processed by this vendor with suggested modifications to their process monitoring.

The second source of wafers is the Electro Optics Dept. at RCA-Lancaster, PA. This silicon technology group is working in cooperation with the Transcalent Device Laboratory in diffusing the wafers, using the original process schedules developed at RCA-Somerville, NJ. The E/O responsibility includes the doping of the wafers as well as oxidation, etching, and polysilicon deposition. The Transcalent Lab is performing the long time drive-ins of both dopants at 1300°C and at 1250°C. The latter furnace tubes have been equipped for automatic slow cooling to assure high voltage junctions. Each facility is equipped to perform the necessary cleaning and photoresist exposure and photoetching operations prior to each furnace process. Metallizing and edge contouring are performed in the Transcalent Lab.

(e) Brazing Fixtures

Brazing fixtures were designed to fabricate a lot of 16 sub-assemblies. However, during the engineering sample phase of the contract only part of the positions are being fully facilitated to enable the fixture design to be checked-out in actual usage. The other positions will be facilitated during fabrication of the confirmatory samples, with any refinements needed.

Figure 9 is a photograph of the first multiple position heat-pipe brazing fixture shown partially loaded with parts. To the left of the fixture are the parts to be joined and the internal parts of the fixture. Drawing No. 3025254 illustrates the use of this anode heat-pipe fixture and references the drawings for each component part of the fixture. This fixture has been used twice without experiencing any difficulties.

Figure 10 shows the plating fixture for electroplating the heat-pipe side of the molybdenum disc with copper. It is necessary to plate the molybdenum with copper to prevent corrosion of the molybdenum by the high purity water used in the heat-pipe. This fixture has been used successfully to plate the inside of the heat-pipe and is detailed in Drawing No. 3025557, Appendix B.

Figure 11 is a photograph of the RCA-owned wicking. fixture to be used also for the MM&TE devices. The drawing number for the wicking fixture is 3025300. This fixture has been used several times without experiencing any difficulties.

The fixture for brazing the gate lead into the ceramic is shown in Figure 12 and its drawing number is 3025556. As a cost reduction, self-jigging parts have been eliminated since the depth of the hole in the fixture establishes the external pin terminal length.

Two attempts were made to braze the gate lead feedthrough into the ceramic insulator. Too much braze material was used in the first attempt and the parts were accidentally brazed to the fixture. In the second try with less solder, one of the two brazes was successful. A metallurgical cross-section was made of the other joint and it was found that the metallizing was too thin. This thickness was increased by painting the ceramic twice with the RCA

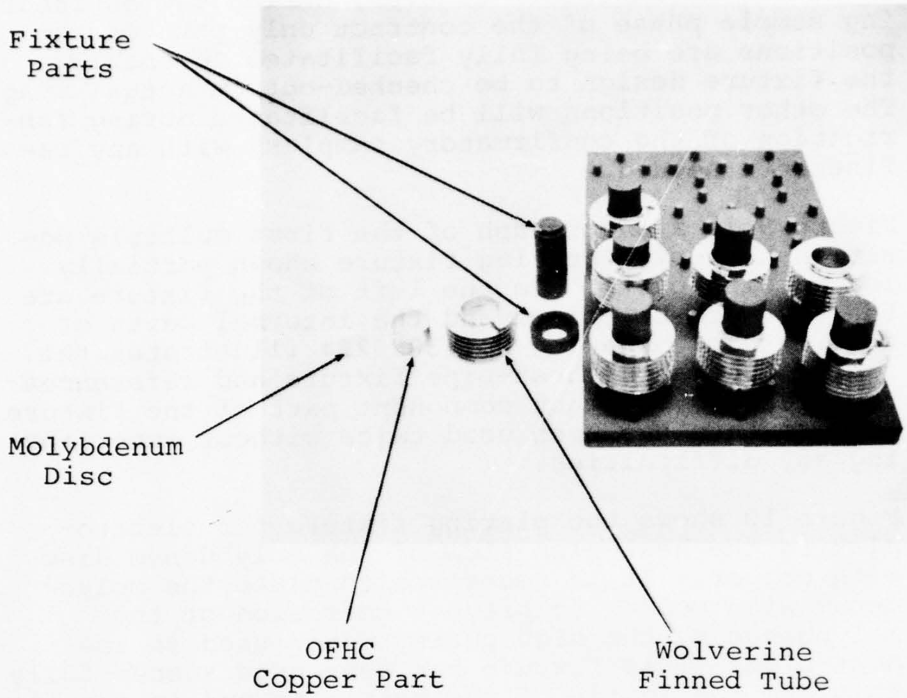


Figure 9. Fixture for brazing the molybdenum disc in the end of the anode heat-pipe and the Wolverine finned tube to the OFHC copper part. This fixture is used to start assembling both the anode and cathode heat-pipes and will be expanded to make 16 brazes simultaneously. Device and fixture parts are shown on the left side of the photograph, prior to assembly.

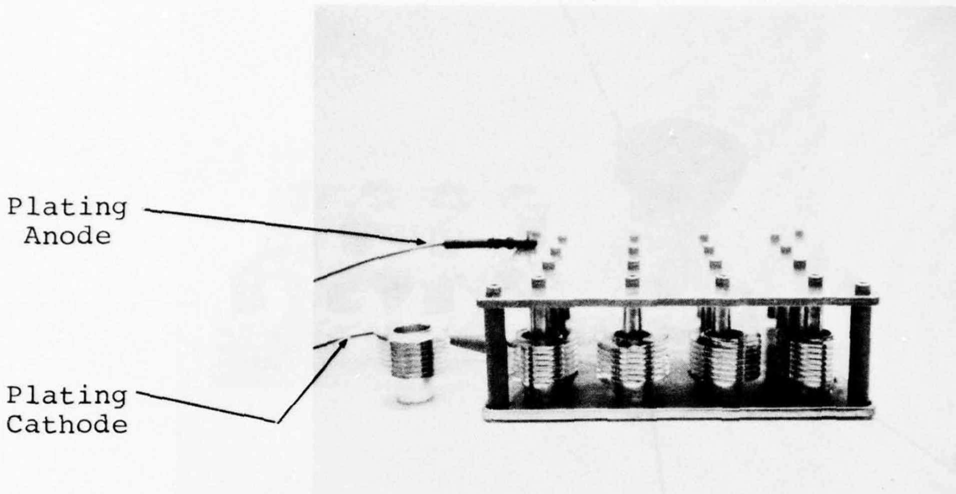


Figure 10. Internal electro-plating fixture: This fixture is used to plate the inside surface of the molybdenum disc with copper. Each heat-pipe is partially filled with the plating electrolyte. Sixteen pipes can be plated simultaneously.

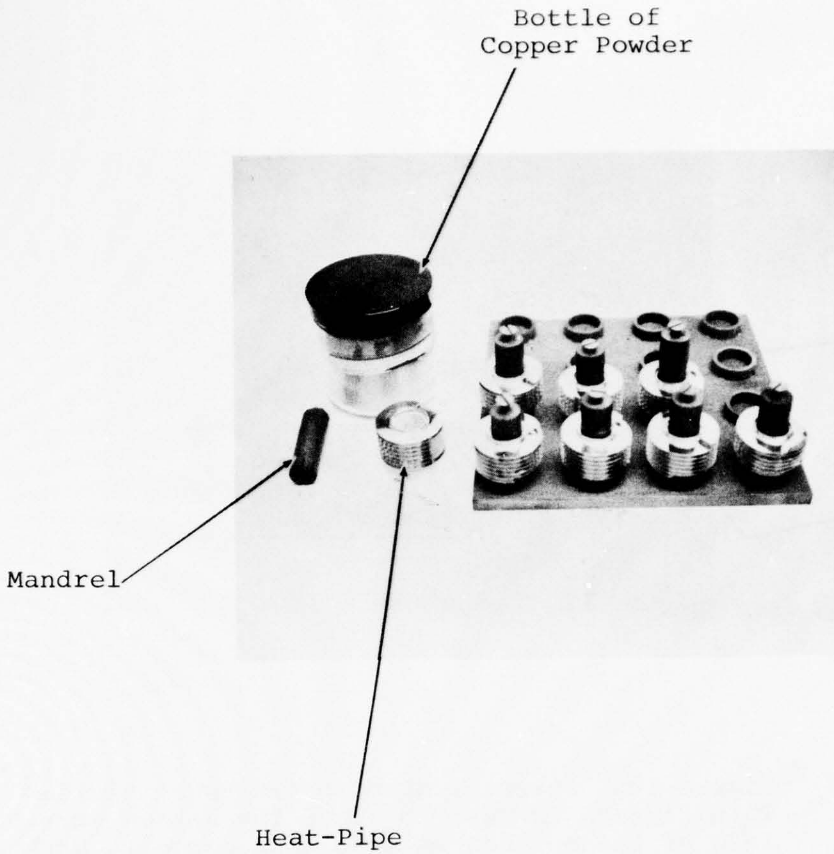


Figure 11. Wicking fixture. Sixteen heat-pipes can be simultaneously wicked using this fixture. Copper powder fills the space between the mandrel shown to the left and the inside wall of the heat-pipe. Slots in the mandrel on the left form the feeder webs within the wick.[e]

[e] U.S. Patent 3,946,429, "Self-Fusing Transcalent Device", Kessler, S. W.

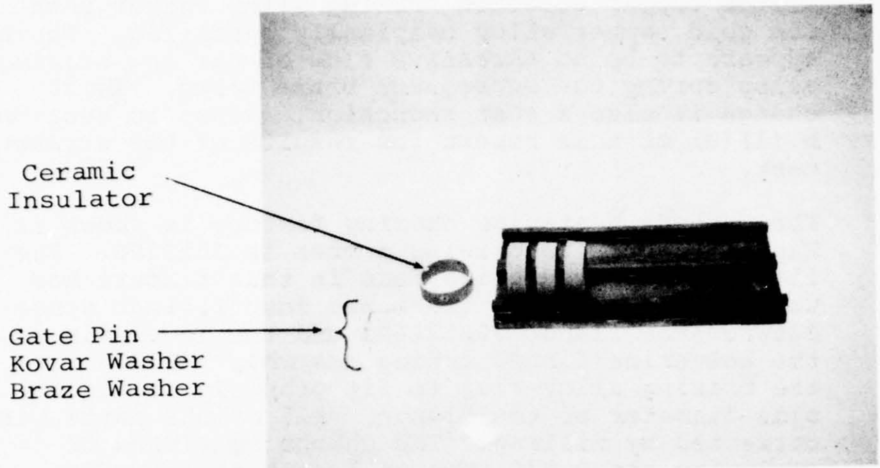


Figure 12. Gate pin braze fixture: This fixture can be used to simultaneously braze 20 gate pins into 20 ceramic insulators. The depth of the hole in the fixture determines the external length of the gate pin. To the left of the fixture are a gate pin with an internal lead inserted into it, a kovar washer and a brazing alloy washer prior to assembly.

proprietary metallizing ink and firing it between each coat.[f] The latest joints were made using a silver copper eutectic brazing alloy rather than the gold copper alloy originally specified. There appears to be no excessive flow of the new brazing alloy during the subsequent braze tests. This change is also a cost reduction. Refer to section b.(1)(a) of this report for results of the strength test.

The cathode heat-pipe brazing fixture is shown in Figure 13 and its drawing number is 3025290. The first brazed assemblies made in this fixture had vacuum leaks because there was insufficient space between the flange 3025225R1 and the lower fin on the Wolverine finned tubing assembly 3025275 for the brazing alloy ring to fit properly at the inside diameter of the flange. All of the parts were corrected by milling. The change consisted of stripping off 0.070 inch of length of this fin from the Wolverine tubing. This extra length of 1.00 inch diameter tubing allowed room for placement of a brazing alloy ring on the joint and also allowed an extra length for the mating Kovar flange braze. Device drawings are in Appendix A.

While this end of the tubing was chucked for the modification, a similar cut was made at the opposite end, but stripping off only 0.020 inch of length. The outer corner of the end fin was also rounded to eliminate the sharp corner that caused concern when the parts were shown at the 10 December Post-Award meeting. A revised copy of the part drawing will be prepared and included in the next quarterly report.

The second attempt to make this braze also failed because of a gap between the ceramic insulator 3025277 and the outer flat of the same flange. At the time of this writing, a split weight is being designed for the fixture to sit on the flange during brazing to maintain flatness and uniform contact. Problems such as these must be resolved frequently whenever a multiple number of brazes are made in one operation using a brazing fixture that performs multiple functions. After debugging, a cost savings should be realized on all future brazes. Other brazing fixtures which are included with the drawings in Appendix B have

[f] RCA data identified as proprietary in paragraph J.41 of the contract.

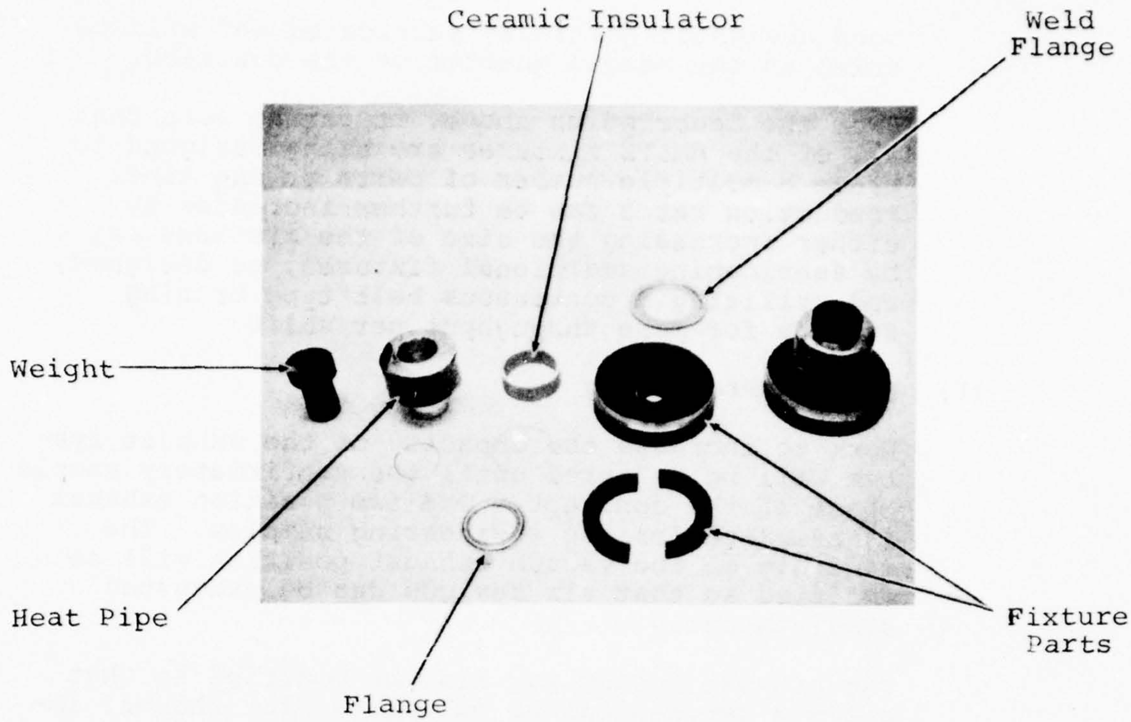


Figure 13. Cathode heat-pipe to ceramic/metal brazing fixture. Four of these fixtures were made. This fixture positions all of the parts shown concentric with the center-line of the heat-pipe. The weld flange and the heat-pipe are positioned by the base of the fixture and the ceramic insulator by the split ring. The flange with the tab is positioned by the heat-pipe. It is this flange which must be weighted during brazing, as described in the text. A loaded fixture is shown on the right side of the photograph.

been designed, partially fabricated and will be tried in the second quarter of the contract.

From the description above, it can be seen that all of the MM&TE fixtures are being designed to braze a multiple number of parts at one time. Production rates can be further increased by either increasing the size of the fixtures or, by fabricating additional fixtures, as designed, and utilizing a continuous belt type brazing furnace for more throughput per shift.

(f) Exhaust Processing

Work to increase the capacity of the exhaust system will be deferred until the confirmatory sample phase of the contract. The two position exhaust is adequate for the engineering samples. The manifold on the vacuum exhaust position will be modified so that six devices can be exhausted simultaneously.

The exhaust system may also be modified so that all six devices can be calibrated for thermal impedance testing during exhaust processing. In this way, it will be possible to calibrate the forward voltage of each device versus temperature while on exhaust bake-out and thus, eliminate an extra operation. Calibration is done by conducting 4 amperes of direct current through the thyristor in the forward direction and measuring the forward voltage drop across the device at selected temperatures. If the device is in thermal equilibrium with the bake-out oven at the selected temperatures, the plot of this temperature versus the measured forward voltage drop can be used to interpret the junction temperature during later thermal impedance testing.

(g) Heli-Arc Welding

New heat sink fixtures have been designed which can be more rapidly clamped onto the devices for heli-arc welding the Kovar and steel parts. These fixtures were originally planned to be water cooled to reduce the waiting time for the heat sinks to cool between welds. However, a new fixture was designed for welding without water cooling. This fixture is shown in Drawing No. 3025566, Appendix B.

The fixture is the heat sink to cool the assembly while welding. Power tube engineers who have years of experience with heli-arc welding of similarly sized small power tubes advised that it is more economical to have a multiple number of convection cooled fixtures for the thyristors. Then one fixture can cool while another is being used to weld the next assembly. The alternative of a water cooled fixture takes additional components and more operator time to load and unload at the welding equipment work station.

(2) Electrical Test Equipment

Three new test equipments have been assembled and checked out as required for 30 different tests (6 methods) for SCS-477, Tables I, II & III, dated 5 December 1974 and Amendment 1, dated 31 August 1976. Two more new test equipments are under construction, as required for two additional tests (2 methods) for SCS-477. The remaining thermal fatigue test equipment modification will augment the five existing test equipments for the remaining nine electrical tests (5 methods). All are listed in Table 1 with the modifications required and present status indicated.

The first two test equipments are portable to facilitate electrical tests under the specified environmental conditions in another laboratory of the plant. The Forward "ON" voltage test set is portable for the same purpose.

Following construction and check-out, each equipment will have calibration schedules established and test procedures written. The form for recording the test results on each thyristor unit has been designed, typed and duplicated. Copies are included as Figures 8a, 8b, 8c and 8d of this report. RCA's Quality and Reliability Activity is coordinating the calibration and test forms.

Functional block diagrams for each test set are shown in Appendix C.

(a) Test Equipment Design

The three most sophisticated test facilities required for the program are those for methods 4224, Circuit Commutated Turn-Off Time; 4066.2, Surge Current; and 3151, Thermal Resistance. Although basic circuit concepts are available in MIL-STD-750B, EIA Standards or RCA-Solid State Division

TABLE 1 (Continued)

ELECTRICAL TEST EQUIPMENT SURVEY (Continued)

Method	Test Descriptions	Inspections	Tests per Device	Equipment Modifications Required	Status of Equipment	Remarks	Block Diagram
	Other Electrical Test Equipment - Separate Test Set for each method.						
4224	Pulse Circuit Commutated Turn-Off Time	Group A, Subgr. 4	1	Engineer design, order components and construct equipment.	Circuit designed and 90% of components received. Equipment constrdction in pro. Temp. controlled oven of 4206.1/4211.1, above.	Test performed previously at Somerville, NJ, plant.	Page C8
4066.2	Surge Current	Group B, Subgr. 1	1	Engineer design of automatic 10 surge sequencing and reverse voltage supply, order components and construct equipment. Design interconnections and controls for 3 separate supplies.	Surge and For. Current Supplies available. 90% of sequencing and reverse voltage components received. Equipment construction is in pro.	Surge current tested previously without reverse voltage at RCA. Reverse blocking tests were also performed at a customer's lab.	Page C9
3151	Thermal Resistance, General	Group C, Subgr. 5	1	Upgrade for Pilot Production.	Engrg. Test facility available.		Page C11
4231.2	Exponential Rate of Voltage Rise	Group A, Subgr. 3	1	To be upgraded to MM&TE and electrical safety requirements.	Engrg. test facility and Temp. controlled oven available.		Page C3
4226.1	Forward "ON" Voltage	Group A, Subgr. 4 Group B, Subgr. 2 Group C, Subgr. 2, 3 & 4	5	Instrumentation and cooling to be added to portable supply.	Power Supply and -25°C environmental chamber available. Instrumentation completed.		Page C4
4201.2	Holding Current	Group A, Subgr. 4	1	Upgrade for Pilot Production	Test facility available.		Page C7
Para. 4.6.2	Thermal Fatigue Test	Group C, Subgr. 4	1	Power supply available but recycling timer, instrumentation, and temperature controls must be replaced.	Components selected and ordered per para. J.42. All received except items 6 & 7.	Equipment is in use for J-15372 Thermal Fatigue Test to be terminated in Jan. 1977 @ 70,000 cycles and equipment converted for MM&TE use.	Page C10
	Total Electrical Tests per Device (with sample sizes per para. 4.4 & 4.5)		41				

*In designing the Blocking Voltage Life Test facility, per para. 4.6.1 and Figure 2 of SCS-477, it was apparent that the value of R1 specified was inconsistent with the values of V_{FBOM}, V_{RBOM} and the one ampere fuses. The RMS current of 0.71 ampere, as limited by the specified value of R1 = 800 ohms, would not blow a one ampere fuse. Thus, the voltage and fuse values were retained and only the value of R1 was reduced to 300 ohms to assure that the fuse would blow and disconnect any test cell component that failed to block high voltage.

TABLE 1 (Continued)

ELECTRICAL TEST EQUIPMENT SURVEY (Continued)

Method	Test Descriptions	Inspections	Tests per Device	Equipment Modifications Required	Status of Equipment	Remarks	Block Diagram
				Other Electrical Test Equipment - Separate Test Set for each method.			
4224	Pulse Circuit Commutated Turn-Off Time	Group A, Subgr. 4	1	Engineer design, order components and construct equipment.	Circuit designed and 90% of components received. Equipment constrdction in pro. Temp. controlled oven of 4206.1/4211.1, above.	Test performed previously at Somerville, NJ, plant.	Page C8
4066.2	Surge Current	Group B, Subgr. 1	1	Engineer design of automatic 10 surge sequencing and reverse voltage supply, order components and construct equipment. Design interconnections and controls for 3 separate supplies.	Surge and For. Current Supplies available. 90% of sequencing and reverse voltage components received. Equipment construction is in pro.	Surge current tested previously without reverse voltage at RCA. Reverse blocking tests were also performed at a customer's lab.	Page C9
3151	Thermal Resistance, General	Group C, Subgr. 5	1	Upgrade for Pilot Production.	Engrg. Test facility available.		Page C11
4231.2	Exponential Rate of Voltage Rise	Group A, Subgr. 3	1	To be upgraded to MM&TE and electrical safety requirements.	Engrg. test facility and Temp. controlled oven available.		Page C3
4226.1	Forward "ON" Voltage	Group A, Subgr. 4 Group B, Subgr. 2 Group C, Subgr. 2, 3 & 4	5	Instrumentation and cooling to be added to portable supply.	Power Supply and -25°C environmental chamber available. Instrumentation completed.		Page C4
4201.2	Holding Current	Group A, Subgr. 4	1	Upgrade for Pilot Production	Test facility available.		Page C7
Para. 4.6.2	Thermal Fatigue Test	Group C, Subgr. 4	1	Power supply available but recycling timer, instrumentation, and temperature controls must be replaced.	Components selected and ordered per para. J.42. All received except items 6 & 7.	Equipment is in use for J-15372 Thermal Fatigue Test to be terminated in Jan. 1977 @ 70,000 cycles and equipment converted for MM&TE use.	Page C10
	Total Electrical Tests per Device (with sample sizes per para. 4.4 & 4.5)		41				

*In designing the Blocking Voltage Life Test facility, per para. 4.6.1 and Figure 2 of SCS-477, it was apparent that the value of R1 specified was inconsistent with the values of V_{FBOM}, V_{RBOM} and the one ampere fuses. The RMS current of 0.71 ampere, as limited by the specified value of R1 = 800 ohms, would not blow a one ampere fuse. Thus, the voltage and fuse values were retained and only the value of R1 was reduced to 300 ohms to assure that the fuse would blow and disconnect any test cell component that failed to block high voltage.

records, component sizes are not specified for the very large (400 amperes RMS) currents and high voltage (800 volts) of the J-15371 Transcalent Thyristor.

Extensive transient design analysis was required for all three of these test sets to achieve the required di/dt, dv/dt, operational sequences and duty factors.

The Thermal Resistance test set was designed, constructed and checked-out in 1975 at RCA expense. This equipment is available for the MM&TE program. Refer to the block diagram in Appendix C for additional circuit details.

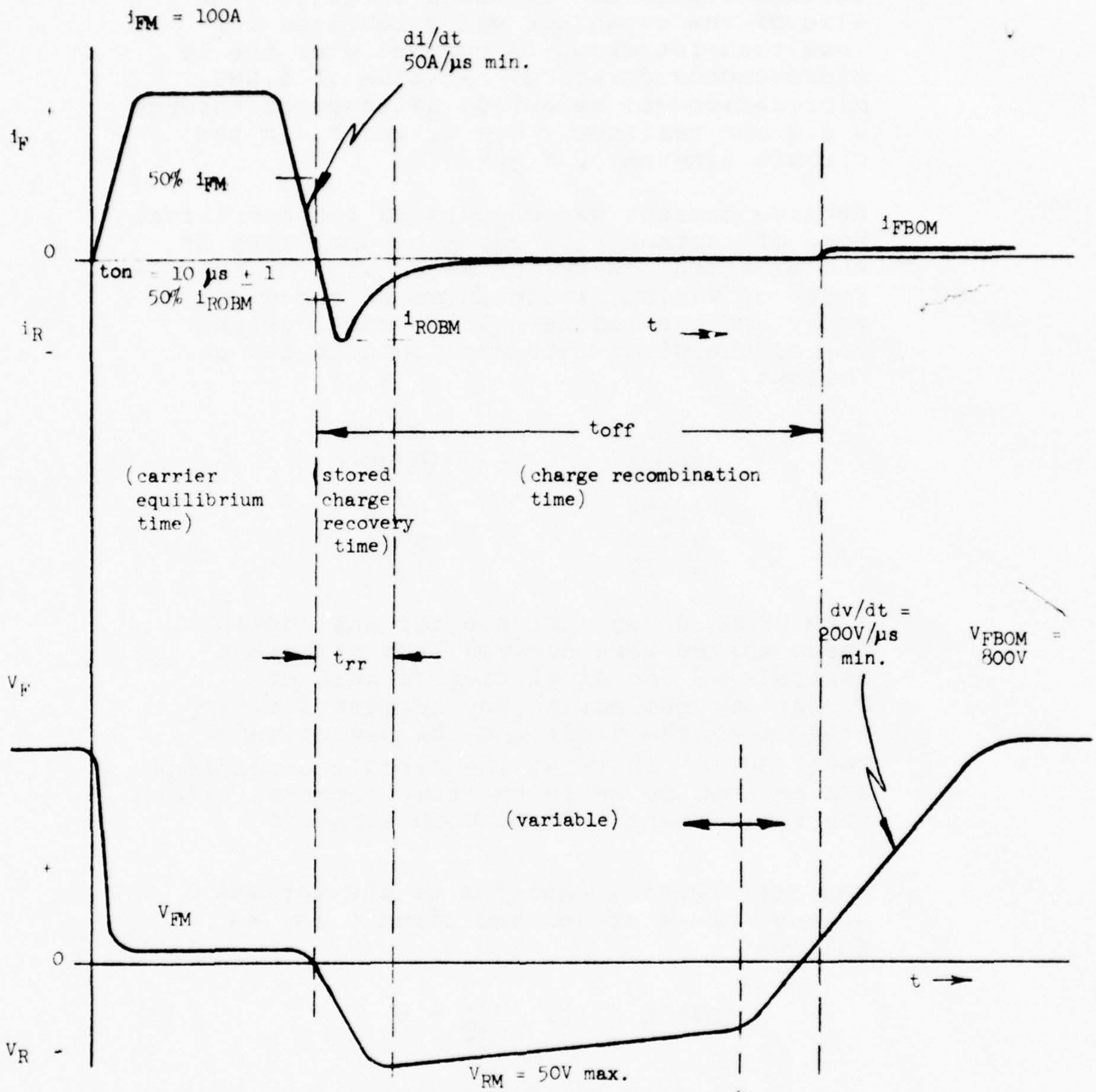
The Turn-Off Time test set was designed on the MM&TE Contract, electronic components were procured with RCA funds and the test set is currently under construction for use in the MM&TE program.

Four distinct, sequential circuit functions are required in the turn-off time test. Refer to Figure 14 for waveforms.

> Application of 100 amperes of forward current for 10 microseconds to assure that the thyristor is fully operating in the "ON"-state,
>
> Application of 50 volts maximum reverse voltage at a reverse current (di/dt) rate of 50 A/μs minimum to turn-off the thyristor,
>
> Reapply forward blocking voltage (800 V. peak) at a dv/dt rate of 200 V/μs minimum after a time interval to allow for recombination, and
>
> Use a shorter and shorter time interval before prior step. The shortest time interval before the thyristor failed to block is defined as the turn-off time.

The repetition rate for these four sequential events is 60 Hz.

Figure 14. J-15371 Turn-Off Time Test



T_A = 25 ± 3° C
Rep. Rate: 60 Hz.
Gate R_1 = 20 Ω max.
Gate Voltage = 5V max.

Note: V_{RM} (@t_1) = 0 min.

Spec: t_{off} = 150 µs max.

Note: Curves based on EIA-NEMA Standard RS-397, Figure 6.17.

Design of the turn-off time circuit will be discussed in the same order.

The forward current pulse involves a low voltage capacitor discharge circuit. The size of the capacitor was calculated for less than 10% droop in current over the 10 microseconds duration. A value of 5,000 microfarads was selected, discharging through a 0.1 ohm resistor. See C_5 and R_1 in the circuit diagram of Figure 15.

Reverse current was calculated for a critical rate of current rise circuit consisting of RLC elements. Refer to Figure 16 for the effects of various inductances on the di/dt rate. In the middle-half of each current curve, the di/dt rate was found to be, as follows:

L1 (μhy)	di/dt (A/μs)
0.235	98.0
0.400	63.9
1.117	13.7

A value of 0.235 microhenries was chosen. These curves were derived from transient analysis of the simplified circuit of Figure 16, neglecting any current limiting effects of the diode and the Device Under Test (DUT). That is, the circuit conditions are assumed to be in the time interval before the solid-state devices both turn-off.

The differential equation of the various voltage drops around the circuit is, as follows:

$$(R2)\,i_L + (L1)\,\frac{d\,i_L}{dt} = E \tag{3}$$

where: R2 is a resistance of 0.25 ohm,
L1 is the inductance (varied) in henries,
E is the supply voltage of 50 volts,

Figure 15. Turn-Off Time Test Set - Reverse Voltage Chassis Design
Effects of Energy Storage Capacitor Sizes

Supply Voltages; EF = 10 v. D.C., E_R = 60 v. D.C.

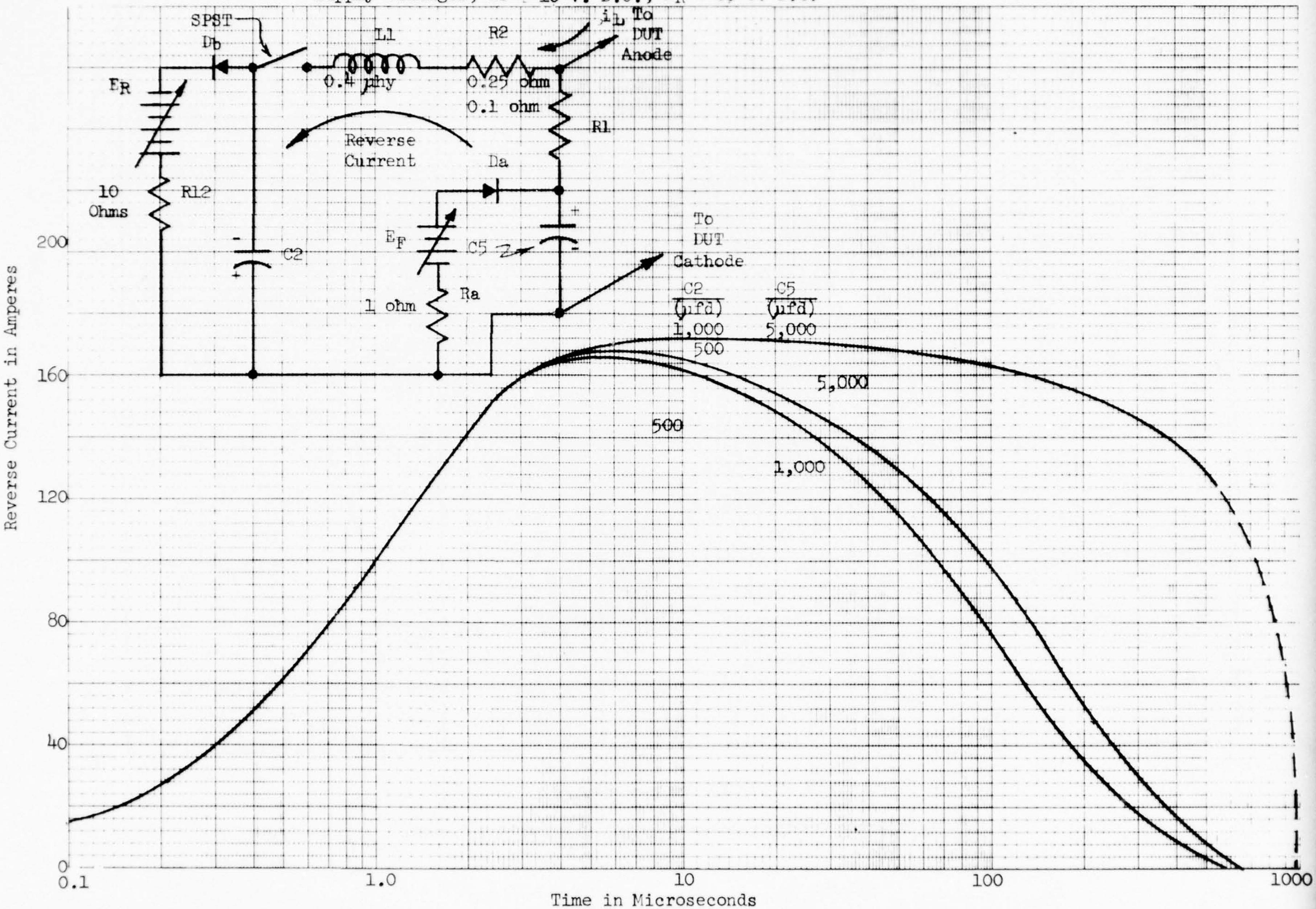
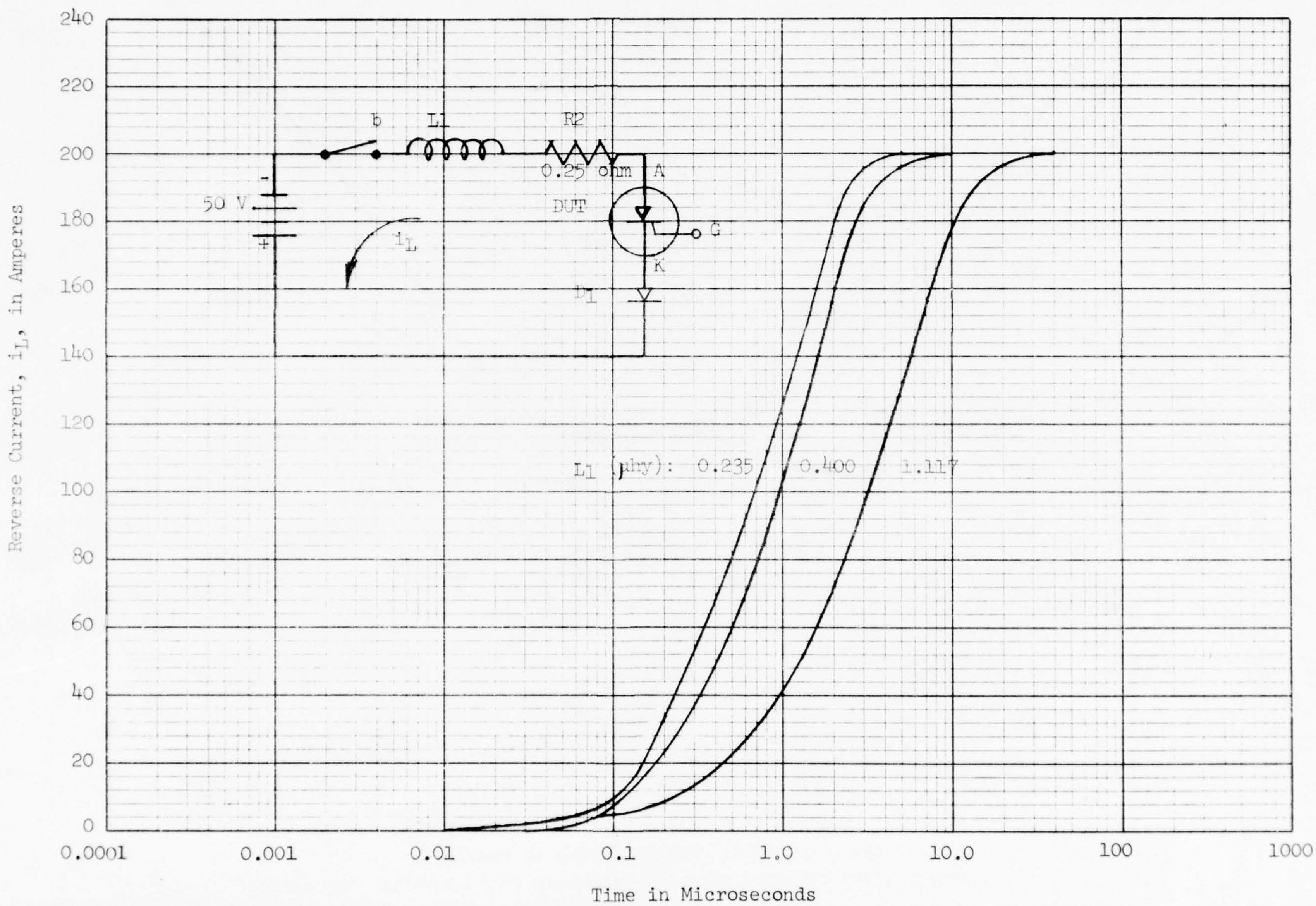


Figure 16. Turn-Off Time Test Set - Reverse Voltage Chassis Design

Effects of Inductance on di/dt



i_L is the instantaneous, transient current in amperes, and,
t is the time in seconds.

The solution of equation (3) for i_L can be shown to be an exponential relationship to R2 and L1.[5]

$$i_L = \frac{E}{(R2)} e^{-\frac{(R2)}{(L1)} t} \qquad (4)$$

It should be apparent that a very small value of inductance is needed.

It should be noted that C2 was omitted from the calculation of i_L for simplicity. C2's value was selected to provide a semi-infinite current source during the interval that i_L flows through the DUT, before turn-off occurs.

However, the interaction between the Reverse Voltage circuit and the forward current circuit must also be considered if components with adequate ratings are to be selected. Refer to Figure 15. R1 and C5 are in parallel with the DUT. C2, ER, L1 and R2 must be adequate to supply this additional unavoidable current path.

Current requirements are also plotted in Figure 15 for various capacitor sizes. The values of the center curve were selected as calculated from the solution of the following second order differential equation[5] (neglecting EF & ER branches in the circuit of Figure 15:

$$(R1+R2)\ i + (L1)\frac{di}{dt} + \frac{1}{(C2)}\int_o^t i\,dt + \frac{1}{(C5)}\int_o^t i\,dt = E$$

$$(R1+R2)\ i + (L1)\frac{di}{dt} + \frac{q02}{(C2)} + \frac{q05}{(C5)} = E \qquad (5)$$

[5] Skilling, H. H., Transient Electric Currents, McGraw-Hill Book Co., Inc., 1937

Where: $\frac{qon}{(Cn)}$ is the initial charge on the capacitor, Cn,

i is the reverse current in amperes, and

E is the total initial charges on the two capacitors, allowing for polarities.

The solution of the over-damped case of (5) avoids oscillation of the reverse current. In sinusoidal form, the current equation is given below.

$$i = 2j \ K_2 \, e^{-\alpha t} \sin \omega t \qquad (6)$$

Where: $j = \sqrt{-1}$

$$K_2 = \frac{\left[\frac{q02}{C2} + \frac{q05}{C5}\right]}{2j(L1)\sqrt{\frac{1}{(L1)}\left(\frac{1}{C2} + \frac{1}{C5}\right) - \frac{(R1+R2)^2}{4(L1)^2}}}$$

$\alpha = \frac{R1+R2}{2(L1)}$, and

$$\omega = \left[\frac{1}{(L1)}\left(\frac{1}{C2} + \frac{1}{C5}\right) - \frac{(R1+R2)^2}{4(L1)^2}\right]^{1/2} \qquad (7)$$

Overdamping requires only that the value of equation (7) be imaginary. The graphs of Figure 15 are thus the instantaneous values of i for various values of t and for the circuit components. Other effects of varying the total supply voltages, E = EF+ER, and the resistance, R2, are shown in Figure 17. Values of 60 volts and one ohm were selected, respectively, to limit dissipations and wire sizes. The total current through L1 and R2 is the sum of i_L and i from equations (4) and (6), respectively.

The Forward Blocking voltage circuit design presented still another challenge in transient circuit analysis. By similarity, the second order differential equation was derived for the simplified circuit of Figure 18. The equation is, as follows (neglecting the E_b branch):

Figure 17. Turn-Off Time Test Set - Reverse Voltage Chassis Design
Effects of Varying Resistance & Supply Voltage

Capacitors ; C2 = 500 µfd, C5 = 5,000 µfd   Inductor, L1 = 0.235 µhy

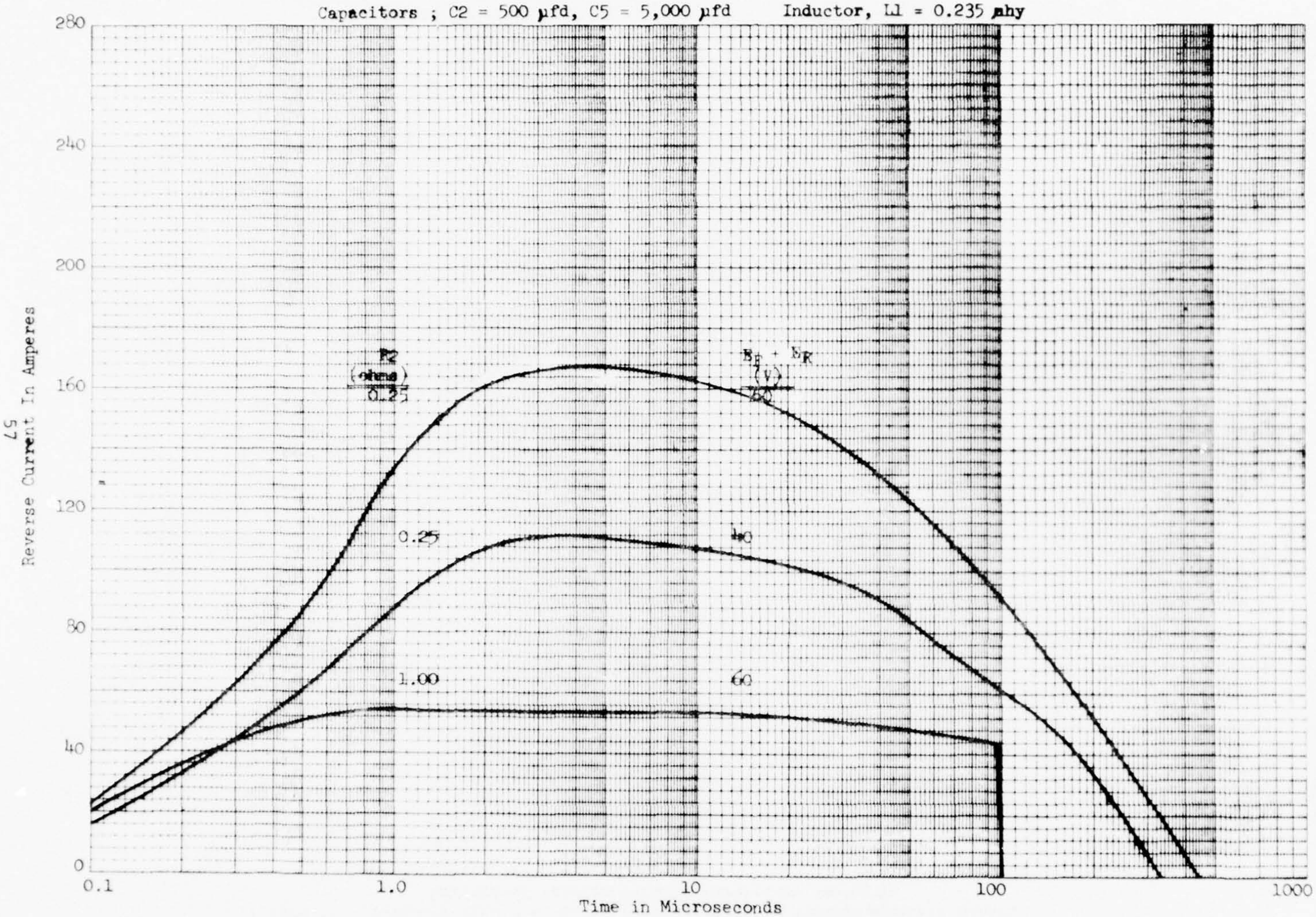
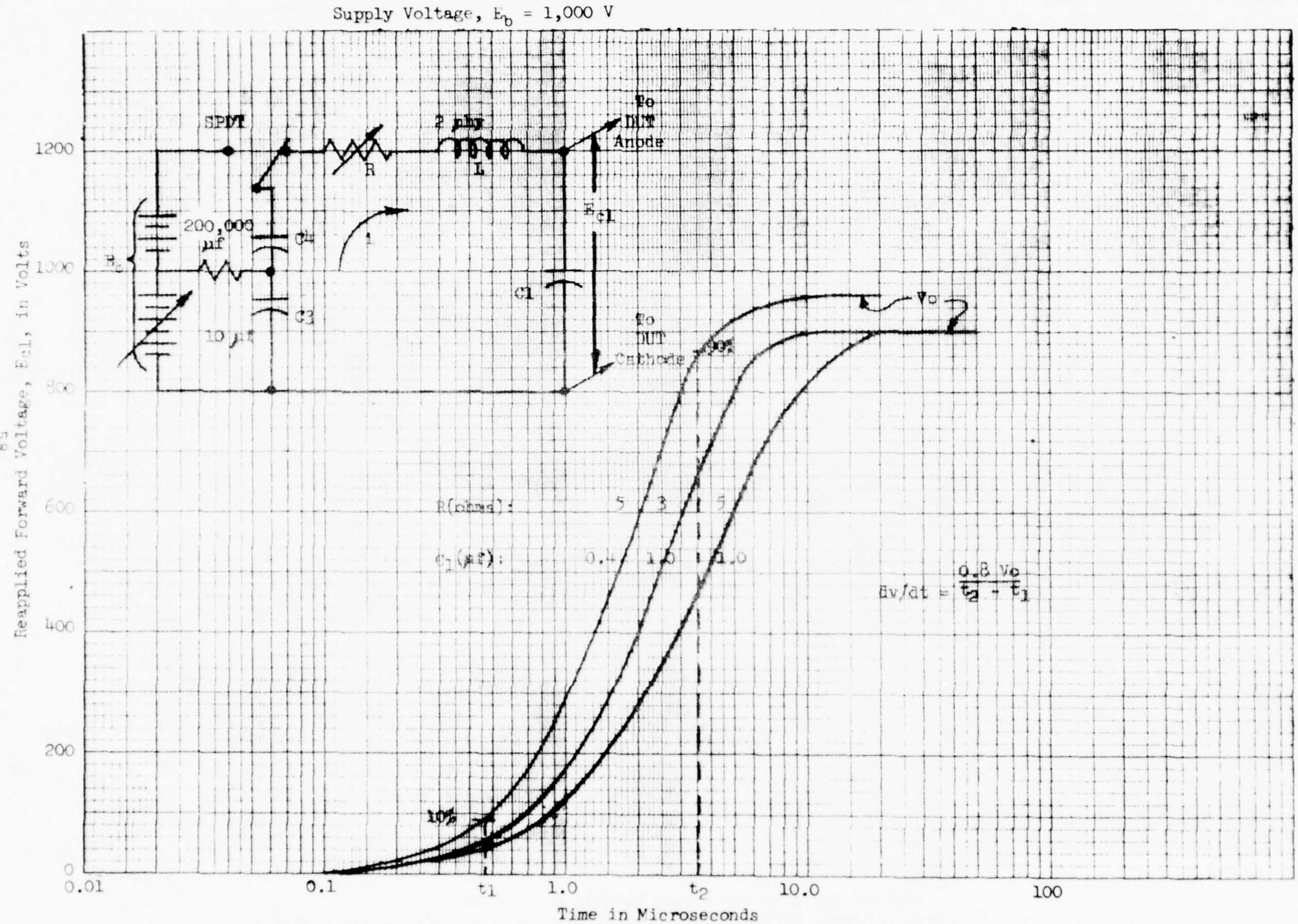


Figure 18. Turn-Off Time Test Set - Forward Blocking Voltage Chassis Design
Effects of Varying Circuit Parameters on dv/dt



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$$Ri + L\frac{di}{dt} + \frac{1}{C_1}\int_o^t idt + \frac{1}{C_3}\int_o^t idt + \frac{1}{C_4}\int_o^t idt = E_b;\ E_{c1} = 0$$

$$Ri + L\frac{di}{dt} + \frac{q01}{C_1} + \frac{q03}{C_3} + \frac{q04}{C_4} = E_b \tag{8}$$

The solution is similar to (6) when allowance is made for the additional capacitor.

$$i = 2\,j\,K2\ e^{-\alpha t}\sin\omega t$$

$$= K_2 e^{-\alpha t}\ (e^{\omega t} - e^{-\omega t}) \tag{9}$$

$$\text{where: } K2 = \frac{\left[\frac{q03}{C3} + \frac{q04}{C4}\right]}{2jL\sqrt{\frac{1}{L}\left(\frac{1}{C_1} + \frac{1}{C_3} + \frac{1}{C_4}\right) - \frac{R2}{4L^2}}};\quad \frac{q01}{C_1} = 0$$

$\alpha = R/2L$, and

$$\omega = \left[\frac{1}{L}\left(\frac{1}{C_1} + \frac{1}{C_3} + \frac{1}{C_4}\right) - \frac{R^2}{4L^2}\right]^{1/2} \tag{10}$$

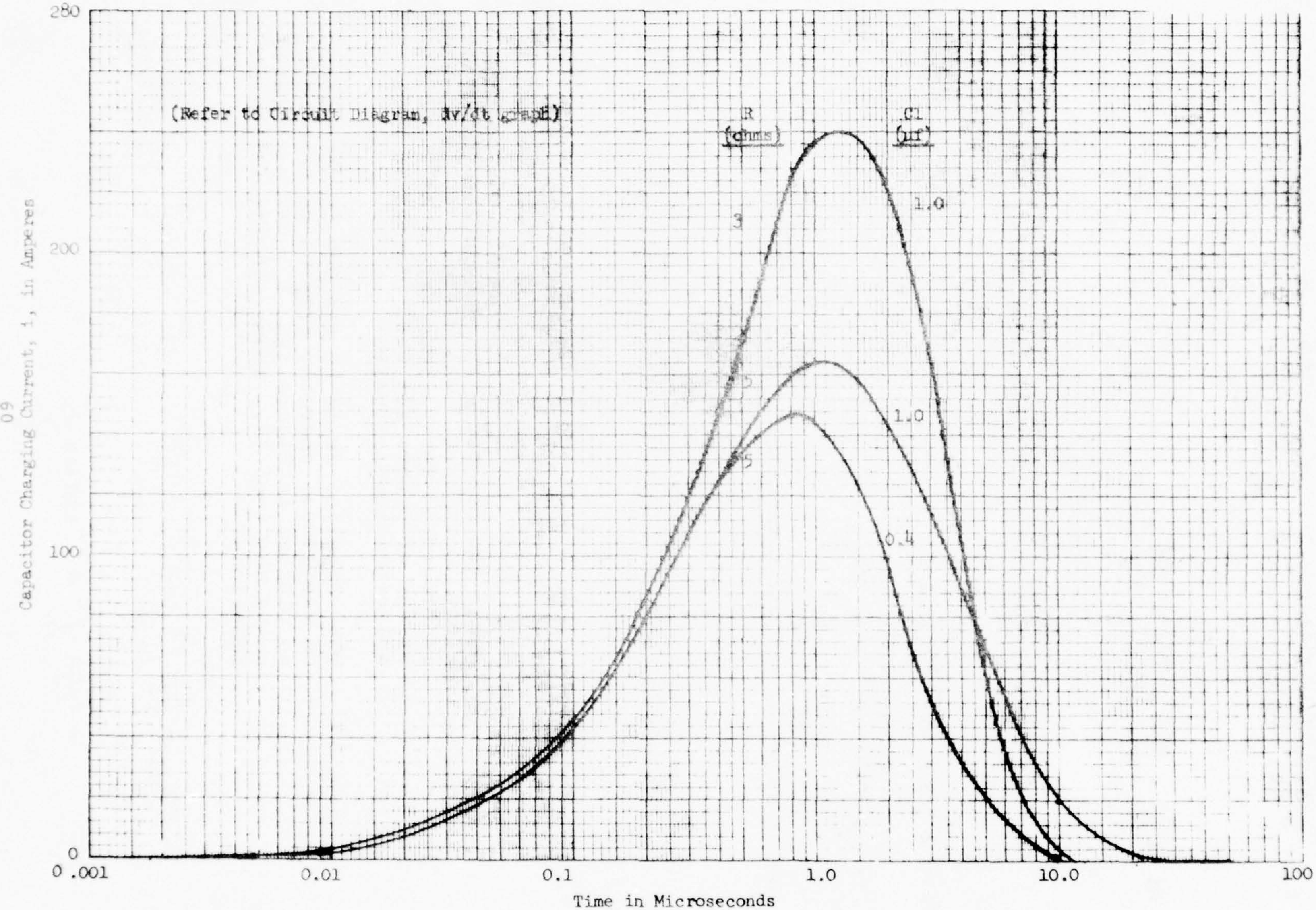
Again the non-oscillatory solution for equation (10) is used. The current, i, is plotted in Figure 19 for various values of R and C1. Values of 5 ohms and 0.35 microfarad were selected, respectively.

The reapplied dv/dt to the DUT is dependent on the linear charging rate of C1 through R, as plotted in Figure 18. E_{C1} was calculated using the i of (9), above, in the following equation.

$$E_{c1} = \frac{1}{C1}\int_o^t idt \tag{11}$$

$$= \frac{2jK2}{C1}\int_o^t e^{-\alpha t}\sin\omega t\ dt$$

Figure 19. Turn-Off Time Test Set - Forward Blocking Voltage Chassis Design
Effects of Varying Circuit Parameters on Charging Current



This integration becomes very complex when the equations for K2, [illegible] and ω are substituted. However, the resulting voltage values for three combinations of R and C1 were calculated with a programable computer and plotted in Figure 18. The resulting dv/dt rates are calculated between the 10% and the 90% points shown on one of the curves.

R (Ohms)	C1 (μfd)	dv/dt (v/μs)
5	0.4	231
3	1.0	158
5	1.0	78

Thus, R & C1 can be varied to achieve the required dv/dt rate of 200 volts per microsecond. Other components, such as current limiting resistors, synchronous switches, meters, etc., have been omitted from the foregoing analysis for simplicity. Refer to the Functional Block Diagram of Appendix C for additional details.

The Surge Current test set for the MM&TE program also requires four distinct, sequential circuit functions.

Application of 250 amperes average (400 amperes RMS) of "on"-state heating current to bring the thyristor junction to its normal operating temperature,

Application of one 60 Hz, positive, 1/2 cycle high current surge to the DUT,

Application of one 60 Hz, negative, 1/2 cycle reverse high voltage pulse to the DUT, and

Repeat the above sequence of operations at one minute intervals for 10 total surges.

Besides interconnecting and sequencing the various power supplies, the circuits have been designed for semi-automatic operation to permit the 10 surge sequence to be accomplished without an operator in attendance. Refer to the Functional Block Diagram of Appendix C for additional circuit details.

The Exponential Rate of Voltage Rise test set was modified for the value of C specified in SCS-477, Table I, subgroup 3. To achieve the required dv/dt rate of 200 volts per microsecond minimum, the value of Rl in the circuit of test method 4231.2 had to be recalculated. Previous operation of this equipment at RCA was with a value of C one order of magnitude less than that specified by the MM&TE contract. Rl values were calculated from the following equation[5] for the required dv/dt.

$$\left[\frac{q01}{C_1} + \frac{1}{C_1}\int_0^t idt\right] + \left[\frac{q0a}{Ca} + \frac{1}{Ca}\int_0^t idt\right] + (R1)i = 0;$$

$$@t = 0, \frac{q01}{C_1} = 0 \tag{12}$$

$$i = \left[\frac{q0a}{(R1)Ca}\right] e^{-\left(\frac{1}{C_1} + \frac{1}{C_a}\right)\frac{t}{(R1)}} \tag{13}$$

Where: Ca is the energy storage capacitor in the power supply, in microfarads (selected for negligible droop when charging Cl),

$\frac{q0a}{C_a}$ is the initial supply voltage, V_{AA}, in volts, and

i is the charging current through Rl to Cl in amperes.

The voltage build-up across Cl is then given by the following equation:

$$E_{C1} = \frac{-q0a}{C_1 + C_a}\left[1 - e^{-\left(\frac{1}{C_1} + \frac{1}{Ca}\right)\frac{t}{(R1)}}\right] \tag{14}$$

Integrating provides the theoretical voltage rate of rise which is applied to the DUT.

$$\frac{dE_{c1}}{dt} = -\frac{q0a}{(R1)C1Ca}\, e^{-\left(\frac{1}{C_1} + \frac{1}{C_a}\right)t/(R1)} \tag{15}$$

A range of R1 values from one-tenth to one ohm was selected to enable higher values of dv/dt to be applied to the thyristors for information purposes. Refer to Appendix C for a block diagram.

Other test circuit design details are relatively straight forward and are presented in the block diagrams of Apprndix C.

d. Conclusions

The processes, tooling and equipment described above as well as the existing RCA facilities are believed to be adequate to produce and evaluate J-15371 thyristors in accordance with SCS-477. Any deficiencies that become evident during the production of the engineering samples will be corrected in the confirmatory sample phase.

e. Drawings and Photographs of Tooling and Equipment

Copies of the drawings of the special tools and fixtures are included in Appendix B. Reference was made to the pertinent drawing numbers in the foregoing discussions of the processing. Photographs were also included above, adjacent to the text references.

Functional block diagrams of the electrical test equipment are included in Appendix C. Circuit diagrams were included above on the graphs discussed in the text.

3. Flow Chart of Manufacturing Process Yield

   To be determined during the Pilot Run.

4. Equipment and Tooling Costs

   Not applicable to a Firm Fixed Price Contract.

5. Data and Analysis on all Units

   Units are to be fabricated and tested in the next quarter of the contract.

6. Specification Changes

   None are apparent, except as discussed at the 10 December 1976 Post-Award Meeting.

7. Requirement for Pilot Run

   Not yet applicable.

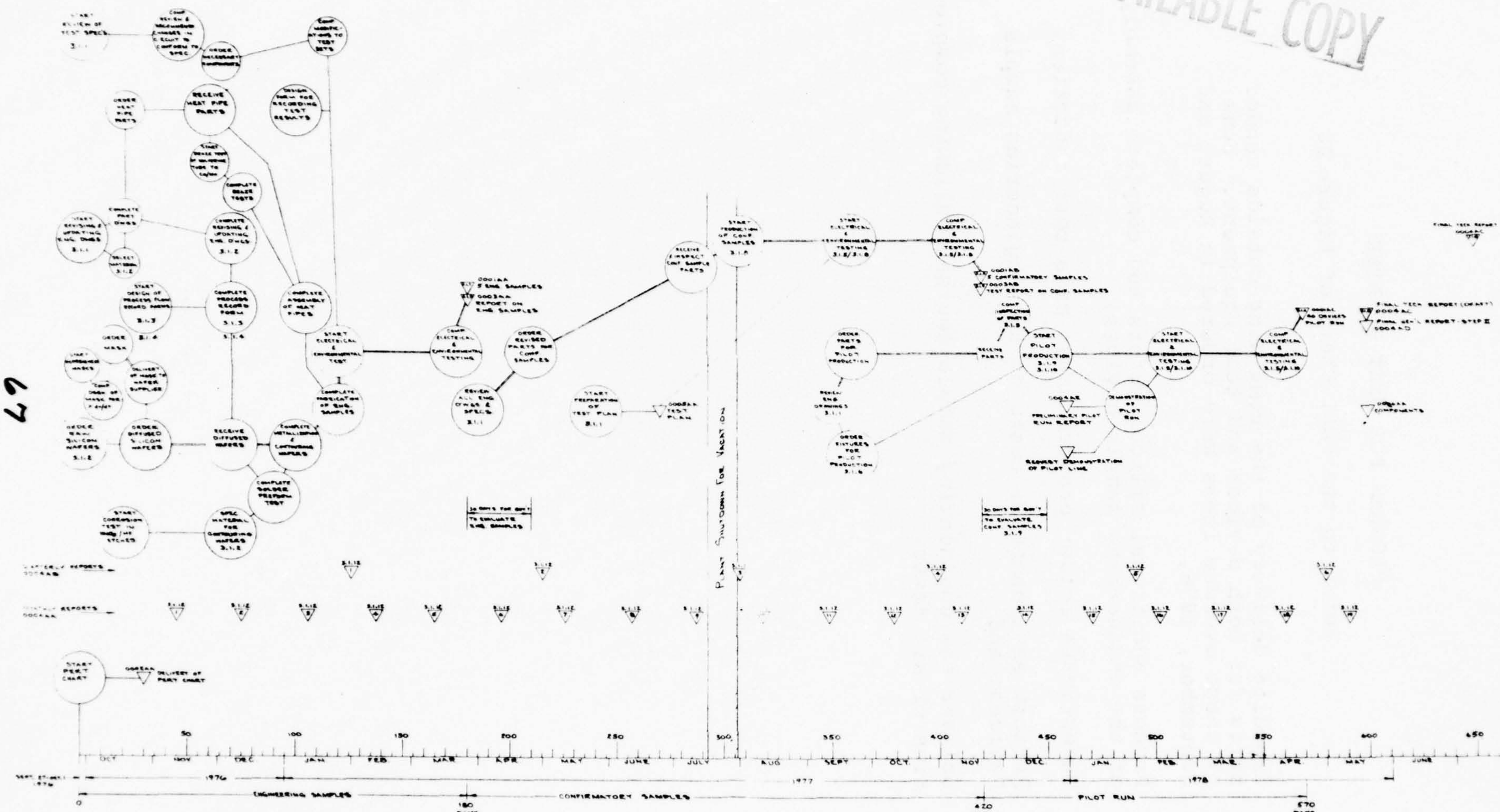
8. Total Cost for Pilot Run

   Not applicable.

9. Program Review

The PERT chart is reproduced in Figure 20 for reference. As of 31 December 1976, the program was on schedule. The first diffused wafers were tested in the laboratory giving preliminary indications that the design value of blocking voltages and the switching capability will be achieved. Heatpipe fabrication began and measures were taken to correct the difficulties as discussed in the text. Corrosion tests and the plating of the engineering drawings were completed. Modifications are in progress to the test equipment so that electrical testing can be started in February, 1977. Process record forms are in use and the test data forms are ahead of schedule.

Overall it is estimated that the program was about 7% completed in the first three months of the contract. There is concern, however, that late delivery of some device parts and some test equipment parts from various outside vendors may jeopardize the schedule in the next quarterly report period. Considerable effort is being expended to expedite these deliveries.



NOTE: THE REQUIREMENTS OF PARAGRAPH 3.1 ARE NOTED WITHIN EACH PLAN MARK BY SUB-PARAGRAPH NUMBER

SCALE: $\frac{1}{16}$" = 1 DAY

RCA

PERT CHART
CONTRACT: DAAB07-76-C-8120
PREPARED BY: [illegible]
DRAWN BY: [illegible]
APPROVED BY: [illegible]

PROGRAM FOR NEXT QUARTER

Refer to the PERT Chart of Figure 20

1. Expedite delivery of the remaining outside vendor parts for both devices and test equipment. Some of these overdue items were ordered in August and September, 1976,
2. Process additional silicon wafers and complete assembly of the engineering sample devices,
3. Investigate solder preform usage as a cost reduction,
4. Perform environmental tests on the engineering sample devices, and
5. Deliver the engineering sample devices following completion of all tests.

IDENTIFICATION OF PERSONNEL

The professional and skilled technical personnel who actually worked on the MM & TE project during the first quarter have varied backgrounds, but both education and experience that is applicable to this contract. Biographical resumes are included.

In addition, numerous supporting personnel including managers, secretaries, purchasing agents, marketing specialists, machinists, electricians, experimental tube builders, etc. have contributed to the progress made in the first three months of the contract.

W. S. Lynch, Manager, Power Products Engineering

W. S. Lynch, Manager, Power Products Engineering, received his Bachelor of Electrical Engineering Degree from the University of Delaware in 1950. Following graduation, he was employed by Westinghouse Electric Corporation and after one year as a trainee served in various quality, manufacturing, engineering, and supervisory assignments with the Lamp Division. He became associated with Western Electric Corporation in late 1955 as an equipment development engineer.

Mr. Lynch was employed by RCA in September 1956 as a production engineer. In 1958, he was promoted to Superintendent and in 1960 became Manager, Camera Tube Production Engineering. He then assumed the position of Manager, Production and Engineering, Camera Tube Manufacturing in 1965. In this capacity, he led a technology team which successfully concluded government contracts pertaining to the development of an Isocon Camera Tube and a 25 mm Intensifier Diode Array Camera Tube (PEM Contract - DAAB 05-71-C-2626). In 1972, as Operations Manager, he assumed responsibility for Product Development Engineering and Manufacturing of RCA Gas Lasers.

Mr. Lynch was assigned to his present position in 1975. His broad manufacturing, process engineering, and product development experience have been instrumental factors in the generation of new products and in improving the performance/cost effectiveness of existing devices.

Robert E. Reed - Leader, Technical Staff, Power Products Materials and Processes Laboratory

Mr. Reed received his B.S. degree in Electrical Engineering with Distinction from the University of Oklahoma in 1952, an M.S. degree in Physics from Franklin and Marshall College in 1971, and has continued his graduate studies with Solid-State Physics courses at F & M College. He has been employed continuously by RCA-Lancaster since June, 1952.

His present assignment combines the supervision of the Materials and Processes Laboratory with the development of the various Transcalent Solid-State Power Devices for both military and industrial applications. Transcalents are heat-pipe cooled, high current, high voltage devices for power switching, conversion, and control applications.

This principal investigator has a diversified background in high-power devices and circuits, including the development of structural methods, evaluation of environmental capabilities, improvements of processing, design of circuits, computer aided design techniques and applications engineering. He pioneered many developments of ceramic-to-metal sealing techniques, carburizing and coating techniques for thermionic cathodes, tuned broadband circuits, and spurious mode suppression, as well as improved exhaust processing and testing methods. High power devices required development of high intensity air and liquid cooling for the high dissipation densities encountered.

In customer service, he actively assisted in the field adjustment of several high power UHF and VHF broadcast transmitters. Assistance was subsequently provided to several military radar, communications and atomic particle accelerator systems as well as to solid state power switching applications.

During another assignment, Mr. Reed was responsible for establishing a contract administration and specifications group for the supervision and control of various Government contracts. This experience is particularly applicable to the present MM & TE contract for Transcalent Thyristors.

For several years, Mr. Reed directed the design engineering group that was responsible for the development of all RCA Large Power gridded tube types. These included the Coaxitron packaged amplifier concept that has advanced the state-of-the-art in broadband-width, grid-controlled tubes for radar service. More recently, engineering support was provided for a very high

power switch tube government contract development.

Subsequently, he was project engineer for a government contract to investigate the causes of spurious r.f. spectrum lines in the amplifiers of high power transmitters under shock and vibration environments. Just prior to the present assignment, he supervised a group of applications engineering specialists assigned to assist customers in circuiting tubes and semiconductor power devices. A new product line of resonant cavity r.f. circuits, some with solid state amplifiers, resulted from this effort.

Mr. Reed is a member of Sigma Tau, Eta Kappa Nu, Sigma Pi Sigma, and the Institute of Electrical and Electronic Engineers. Several papers and technical reports have been written and published by him.

S. W. Kessler, Jr. - Senior Member, Technical Staff

Mr. Kessler received his B.S. degree in Industrial Engineering from the University of Pittsburgh in 1949. While engaged in metallurgical graduate work at Johns Hopkins University from 1949 to 1953, Mr. Kessler worked as a Research Assistant, investigating the kinetics of the solidification of metals. He also instructed in the Materials Laboratory

He joined RCA-Lancaster in 1953 and was assigned to the Chemical and Physical Laboratory, where he worked on the development of glass-to-metal and ceramic-to-metal seals.

While in the U. S. Army from 1954 to 1956, he was stationed at the Ballistic Research Laboratory, Aberdeen Proving Grounds, investigating the deformation of space charges. Upon his discharge, Mr. Kessler returned to RCA and spent two additional years at the Chemical and Physical Laboratory. He was later assigned to the RCA Semiconductor and Materials Division, where for four years he specialized in the metallurgical aspects of silicon power rectifier design and the diffusion of doping elements into silicon.

He was associated with the Special Power Device Engineering group in Lancaster from 1962 to 1967. His work included the development of high-temperature, high strength ceramic-to-metal seals, stress analysis of seals, corrosion of material by the alkali metals.

These material investigations pioneered RCA's position in the development of thermionic energy converters, cesium metal vapor arc lamps and heat pipes. He was also engaged in the development of electron beam welding of the refractory metals and the fabrication and development of a high temperature ceramic metal transition from a heat pipe flame barrier to the emitter of a converter for the U. S. Army Electronics Command.

In 1967, Mr. Kessler was transferred to Somerville, New Jersey, to take part in a crash program of metallizing and bonding solid state integrated circuits.

In 1968, Mr. Kessler returned to Lancaster to join the Power Tube Department. Since he joined the Power Tube Department, he has pioneered the development of Transcalent Solid-State Power Devices. A Transcalent Device employs heat pipes integrally formed to the silicon to minimize the thermal impedance between the junction and heat sink and also to provide an isothermal heat sink for dissipating the power losses. The

devices developed include 250 and 900 ampere rectifiers, 400 and 1400 ampere silicon controlled rectifiers and a 60 ampere, 700 volt transistor. During this time he has also been available for consultation on material problems as they arise in the Power Tube engineering and manufacturing activities.

Mr. Kessler has authored and co-authored numerous papers on the subject of ceramic-to-metal seals, corrosion by alkali metals, heat pipes and Transcalent Solid State Power Devices. He has been granted seven U. S. Patents.

Mr. Kessler belongs to the American Society for Metals and the Institute of Electrical and Electronic Engineers.

C. Allen Mannon - Senior Member, Technical Staff Quality and Reliability Assurance

Mr. Mannon received his B. A. degree in Mathematics/Engineering from the University of Delaware in 1953 and an M. S. degree in Statistical Quality Control from Rutgers University in 1959. For over two years, he was resident Quality Supervisor in Spain responsible for vendor quality assurance from eight European suppliers in England, Germany, Italy and Spain.

Mr. Mannon joined RCA, Somerville in 1959 and was responsible for Quality Control systems for Germanium and Silicon transistors, Integrated Circuits, High Reliability Programs, Memory Cores and various special products.

In 1969, Mr. Mannon was transferred to RCA, Lancaster, working in Quality and Reliability Assurance for Microwave Products, camera tubes, solid state devices and power tubes.

Mr. Mannon is a Senior Member of the American Society for Quality Control, a Certified Quality Engineer, and a registered Professional Quality Engineer.

W. Thomas Burkins - Associate Engineering Technician, Transcalent Development

Mr. Burkins graduated from Penn State University in 1961 with an Associate of Science Degree in Electrical Engineering. He has subsequently completed three Company sponsored physics courses and most recently, a course on Silicon Devices Technology.

He joined the Power Tube Design group at RCA-Lancaster in 1961 and participated in the design and development of several small power tubes including the RCA 4624 Cermolox DA tetrode. He later transferred to the applications engineering group where for several years he worked on customer related circuits and applications. In 1970, Mr. Burkins was assigned to the Power Tube RF Cavity and Module group where he was instrumental in working out the pilot production for the multi-stage broadband L-Band Radar Module.

In 1973 he joined the Transcalent (Heat-pipe cooled) Devices Development Program and helped fabricate and test 10 - J15372 Transcalent SCR's and 18 - J15379 Transcalent Rectifiers for the U. S. Navy. Following the completion of that program, Mr. Burkins worked on the development of the two-inch diameter J15461 thyristor and J15463 rectifier, both of which exceeded the design goals. The thyristor has a peak surge rating of 20,000 amperes at voltages up to 1,400 volts.

Mr. Burkins' latest efforts have been on the Government funded Transcalent Transistor development program. Processes utilized include CVD metallizing, photoresist masking, chemical etching, silicon diffusion, vacuum/hydrogen soldering, heliarc welding, vacuum exhausting and power testing.

Robert M. Hopkins - Associate Engineering Technician, Developmental Processes

Mr. Hopkins' education includes two years at the State Teachers College, East Stroudsburg, Pennsylvania, evening courses at Franklin and Marshall College, Lancaster, Pennsylvania, and home study courses in basic Electronics from DeVry Technical Institute, Chicago, Illinois.

He joined RCA in 1952 as a trolley exhaust operator for experimental kinescopes and subsequently transferred to the Parts Works as a partsmaker in 1953.

In 1955 he transferred to the C & P Lab as a Technician, working with the R & D of ceramic-to-metal seals. This assignment spanned the next twenty years. Responsibilities included the construction, operation and maintenance of furnaces for processing ceramics for use in electronic devices, the cutting, grinding and firing of ceramics for pilot projects; the preparation of metallizing inks for both experimental and production uses; the testing and evaluation of metallizing inks and the application thereof to various ceramic bodies; as well as the mounting and polishing of samples for metalographic inspection. In 1974 he began an assignment for the construction of electronic test circuits for transcalent solid state devices. He continues in this assignment at the present time for a government funded MM & TE contract.

Robert E. Miles - Mechanical Draftsman Designer A

Mr. Miles joined the Power Tube Design activity of RCA in 1955. He has participated in the design of many major programs at RCA, such as the Klystron, Magnetron and Coaxitron Power Tubes. He was also active in the Air Force BMEWS program. As a draftsman, he has contributed to the design of brazing fixtures and tools for the assembly of tubes and Transcalent devices.

Prior to Joining RCA, Mr. Miles was employed by the Pennsylvania Water and Power Company at Safe Harbor and Holtwood Power Stations and attended the Milwaukee School of Engineering. From 1951 to 1953 he served in the U. S. Army.

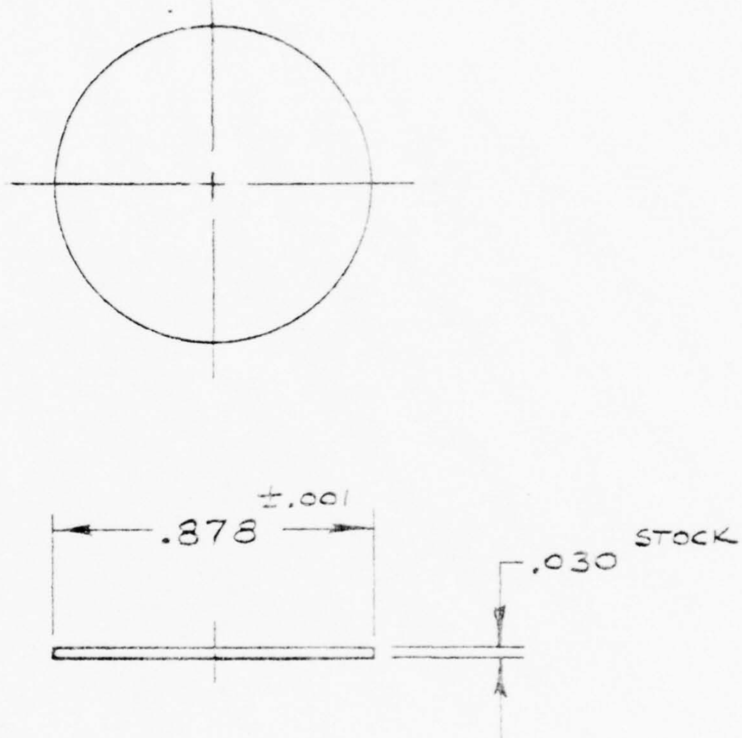
APPENDIX A

J-15371 Parts and Assembly Drawings

(Note: Organized in numerical order by drawing number.)

DIMENSIONS ARE IN INCHES, AND INCLUDE THICKNESS OF PLATING. DO NOT SCALE DRAWING. ALL EXTERNAL THREADS TO BE CLASS 2A BEFORE PLATING AND CLASS 2 AFTER PLATING; ALL INTERNAL THREADS TO BE CLASS 2B, UNLESS OTHERWISE SPECIFIED.

3025203R2



NOTE -

1. OUTSIDE DIA. TO BE FREE OF SPLITS OR SIGNS OF LAMINATING.
2. DISC TO BE FLAT WITHIN .001"
3. NICKEL PLATE PER SCHED. N-1

RADIO CORPORATION OF AMERICA

REVISIONS

AP. BY	
AP. MFG	0
TITLE WAS MOLY HEAT SINK	1
ADDED NOTE 3	2

MATERIAL - MOLY (PHILIPS ELMET)
.030" TH. × 1 1/8" SQ / PART

MOLY DISC

FIRST MADE FOR 250 AMP USED ON

DRAWN BY R.F. KELLER 1-8-74

DESIGNED BY

CHECKED BY

COMMODITY CODE

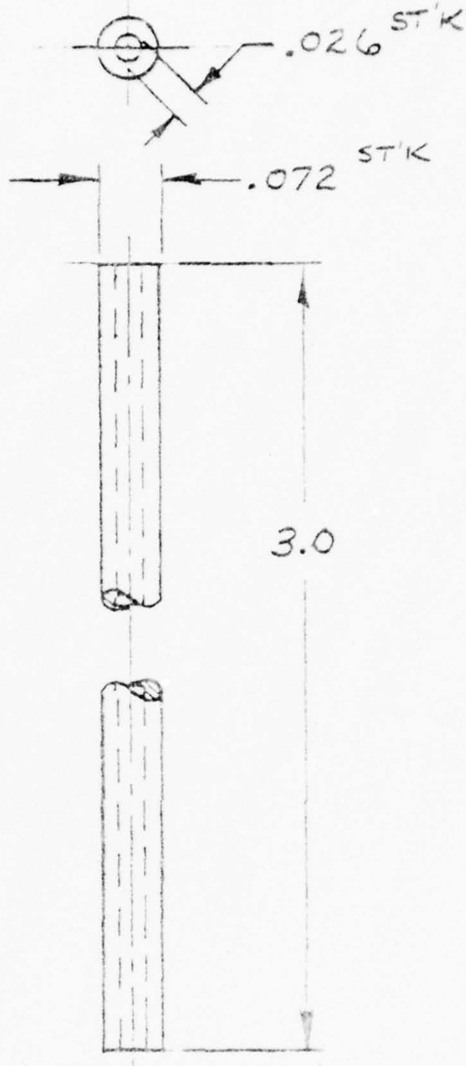
SIZE A 3025203R2

SHEET CONT'D. ON SHEET

DIMENSIONS ARE IN INCHES, AND INCLUDE THICKNESS OF PLATING. DO NOT SCALE DRAWING. ALL EXTERNAL THREADS TO BE CLASS 2A BEFORE PLATING AND CLASS 2 AFTER PLATING; ALL INTERNAL THREADS TO BE CLASS 2B, UNLESS OTHERWISE SPECIFIED.

3025207R2

FORMER ENG. NO. A-289-14



RADIO CORPORATION OF AMERICA

NOTES –
1. DEBURR I.D.
2. BENDING OF TUBE IS PERMITTED IF IT DOES COLLAPSE THE I.D.

MATERIAL ~ OFHC CAPILLARY TUBE (TC-26) COPPER	EXHAUST TUBULATION
	FIRST MADE FOR 250 AMP USED ON
	DRAWN BY R.F. KELLER 1-23-74
	DESIGNED BY
	CHECKED BY
	COMMODITY CODE
	A SIZE 3025207R2
	SHEET CONT'D. ON SHEET

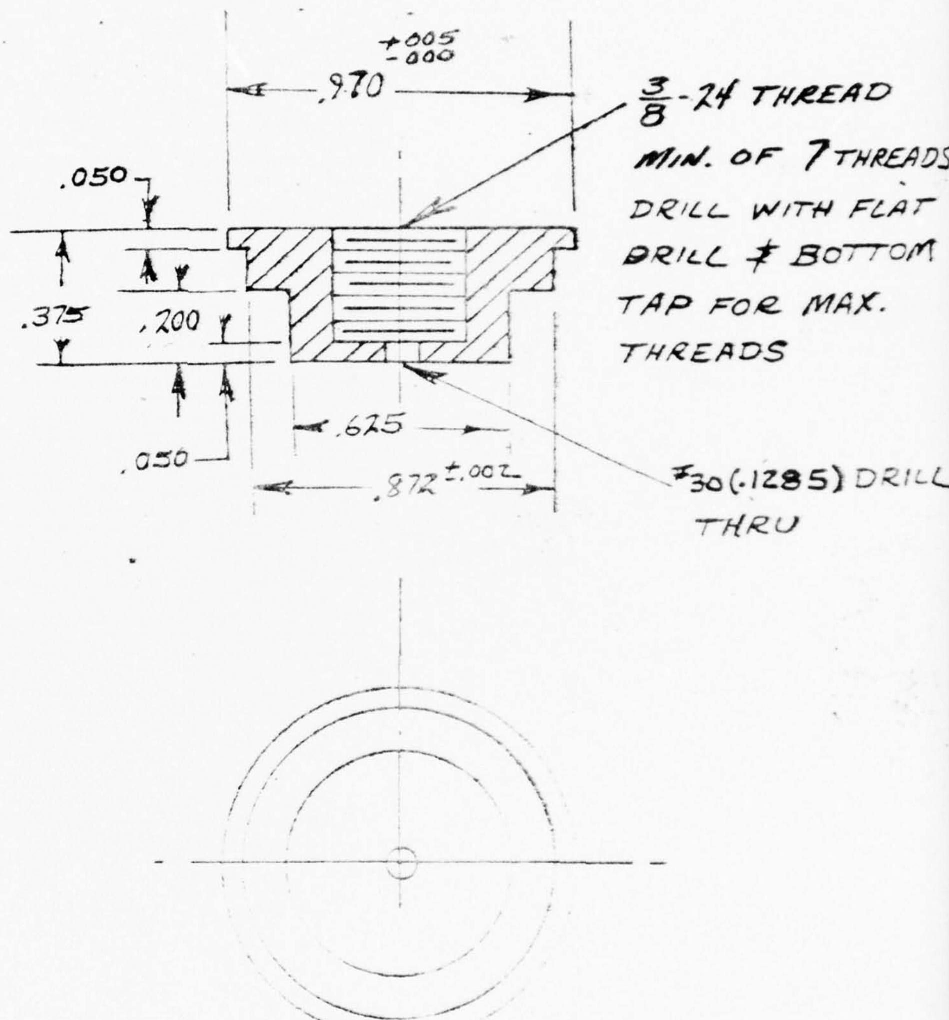
REVISIONS: 0 | AP. BY | AP. MFG | I.D. WAS .020 R.Miles 8/7/76 1 | ADDED NOTES 1&2 R.Miles 10/5/76 2

REVISIONS

P. BY	DATE	0
increased OD from .950 to .970 10/20/75 AWK		1
30(.1285) DIA. WAS 49(.073) DIA. R. Miles 9/8/76		2

DIMENSIONS ARE IN INCHES AND INCLUDE THICKNESS OF PLATING. DO NOT SCALE DRAWING. ALL EXTERNAL THREADS TO BE CLASS 2A BEFORE PLATING AND NOT GREATER THAN THE MAXIMUM SIZE OF CLASS 3A AFTER PLATING. ALL INTERNAL THREADS TO BE CLASS 2B UNLESS OTHERWISE SPECIFIED. ALL THREADS TO BE UNIFIED STANDARD SCREW THREAD SERIES UNLESS OTHERWISE SPECIFIED.

3025212R2



MATERIAL OFHC COPPER C 600 D
1.00" DIA X .5" / PART

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TOLERANCES AND WORKMANSHIP REQUIREMENTS NOT SPECIFIED ON THIS DRAWING SHALL CONFORM TO SPECIFICATION 93650.

BASIC DIMENSIONS	2 PLACE DECIMALS	3 PLACE DECIMALS
UP THRU 6		
6 THRU 24		
ABOVE 24		
ANGULAR DIMENSIONS		

RCA — RCA CORPORATION

END CAP

FIRST MADE FOR — USED ON

DRAWN BY AWKessler 10/14/74

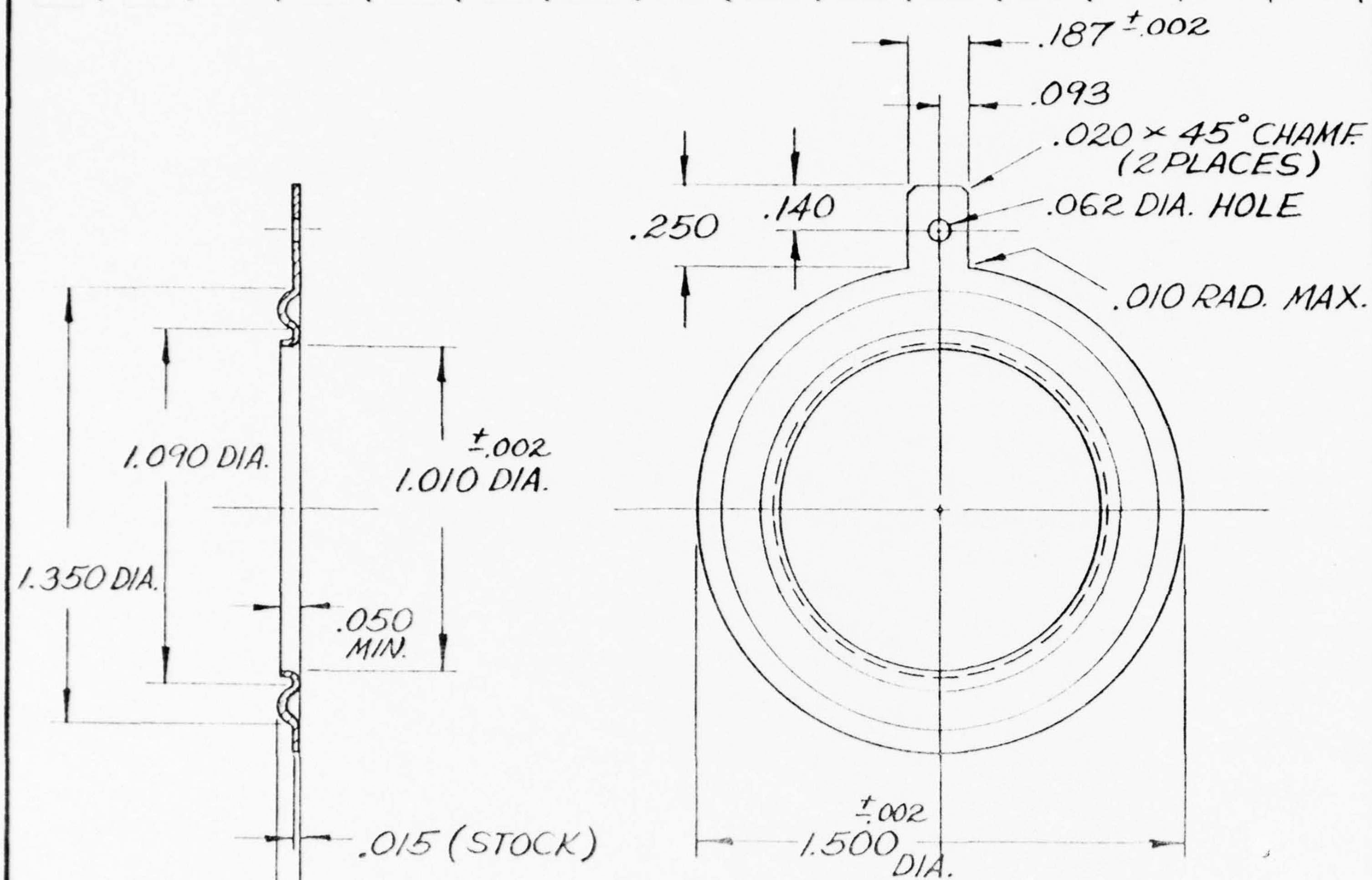
DESIGNED BY AWKessler 10/14/74

CHECKED BY

COMMODITY CODE

A SIZE — 3025212R2

CODE IDENT NO. 49671 — SHEET — CONT'D ON SH



NOTES:
1. FIRE IN LINE HYDROGEN FOR 30 MIN. @ 900°C & @ 1100°C FOR 10-20 MIN. (AT RCA)

CHECKED BY

APPROVED BY

0

NOTE WAS FIRE IN LINE H_2 FOR 30 MIN. @ 1030°C BEFORE PLATING - NICKEL PLATE .0008-.0005 TH'K. SURFACE MUST NOT BLISTER WHEN FIRED @ 900°C IN H_2
R. Miles Oct. 5, 1976

1

STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED

SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

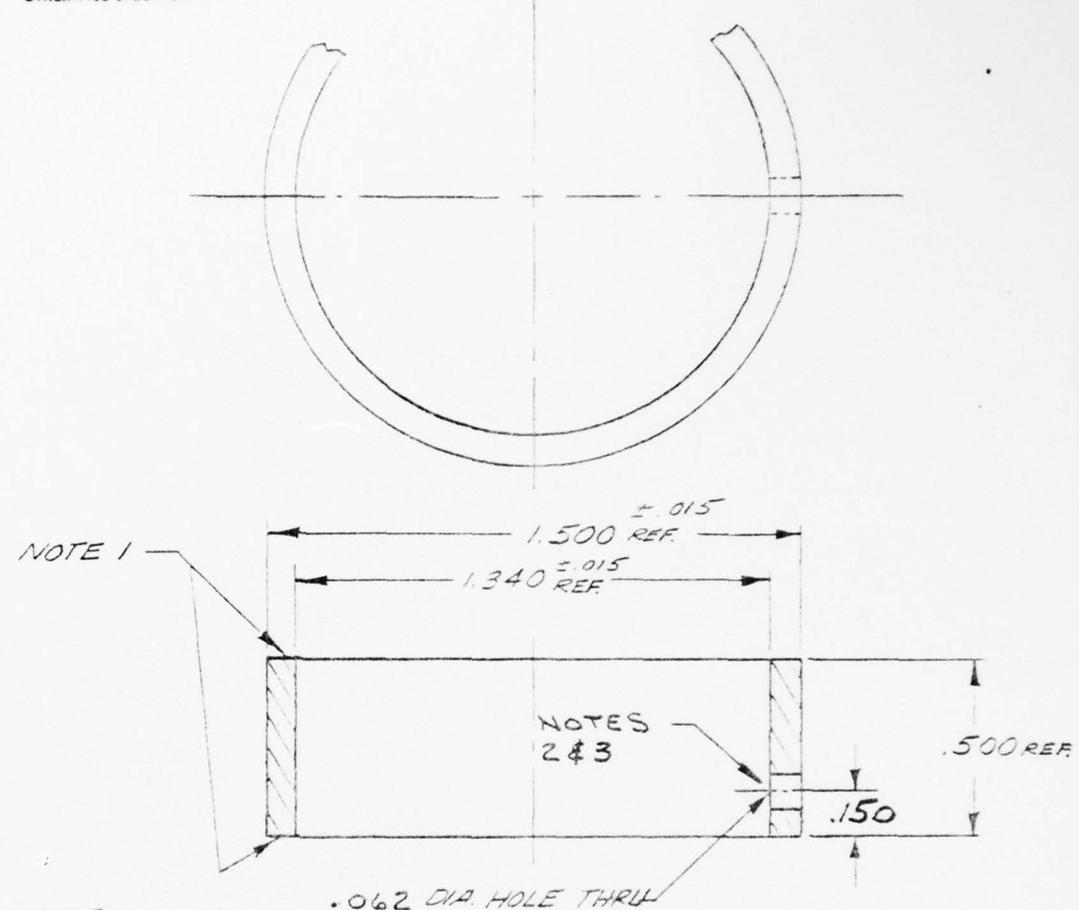
MATERIAL			DWG. TITLE	
.015 THICK I6857 (KOVAR)			CATHODE FLANGE	
PATTERN NO. 2.0 x 2.0	SCALE 2:1	USED ON	DESIGN BY	MODEL NO
RCA Electronic Components EQUIPMENT DEVELOPMENT			DRAWN BY R. FRANKHOUSER 11-20-74	SIZE A DWG. NO 3025225R1

DIMENSIONS ARE IN INCHES AND INCLUDE THICKNESS OF PLATING. DO NOT SCALE DRAWING. ALL EXTERNAL THREADS TO BE CLASS 2A BEFORE PLATING AND NOT GREATER THAN THE MAXIMUM SIZE OF CLASS 3A AFTER PLATING. ALL INTERNAL THREADS TO BE CLASS 2B UNLESS OTHERWISE SPECIFIED. ALL THREADS TO BE UNIFIED STANDARD SCREW THREAD SERIES UNLESS OTHERWISE SPECIFIED.

302 5227 R3

REVISIONS

BY / DATE	
	0
CHANGE .125" GATE LEAD HOLE CENTERLINE DIM. TO .150 WTB 12/19/75	1
NOTE 2 WAS TO ... D. ... miles 9/7/76	2
GEN'L REV. ... miles ... 28, ...	3



NOTES:

1. METALLIZE & PLATE PER STDZG. NOT. #13-1-2MP, PG. 6200 J
2. BREAK-OUT CHIPS ON INSIDE OF HOLE SHOULD BE LIMITED TO .025 FROM CIRCUMFERENCE OF HOLE
3. METALLIZE, ON THE INSIDE SURFACE, A RING .150 DIA. & CONCENTRIC WITH .062 DIA.
   INSPECT: CLEAN I.D. OF .062 DIA. HOLE, IF NEEDED, & CHECK THAT THERE IS NO SHORT TO THE METALLIZING ON THE ENDS

MAT'L: I6009M (C279A)
HI-ALUMINA CER

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TOLERANCES AND WORKMANSHIP REQUIREMENTS NOT SPECIFIED ON THIS DRAWING SHALL CONFORM TO SPECIFICATION 93650.

BASIC DIMENSIONS	2 PLACE DECIMALS	3 PLACE DECIMALS
UP THRU 6		
6 THRU 24		
ABOVE 24		
ANGULAR DIMENSIONS		

RCA CORPORATION

INSULATOR

FIRST MADE FOR — USED ON

DRAWN BY R.G. HERR 2-6-75

DESIGNED BY S.W. KESSLER

CHECKED BY

COMMODITY CODE

A SIZE — 302 5227 R3

CODE IDENT NO. 49671 — SHEET — CONT'D ON SH

REVISIONS

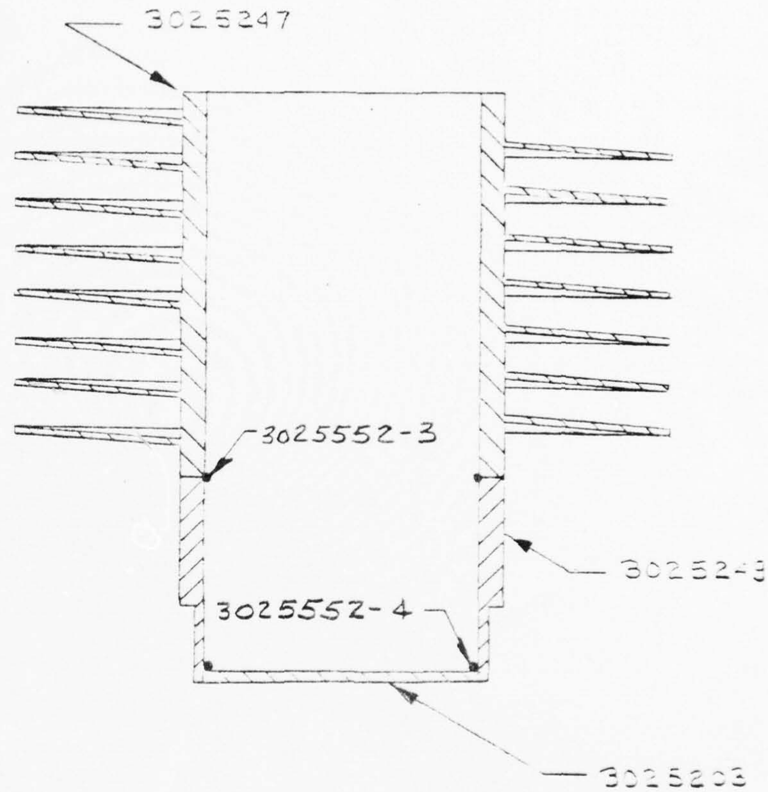
BY

DATE

0

DIMENSIONS ARE IN INCHES AND INCLUDE THICKNESS OF PLATING. DO NOT SCALE DRAWING. ALL EXTERNAL THREADS TO BE CLASS 2A BEFORE PLATING AND NOT GREATER THAN THE MAXIMUM SIZE OF CLASS 3A AFTER PLATING. ALL INTERNAL THREADS TO BE CLASS 2B UNLESS OTHERWISE SPECIFIED. ALL THREADS TO BE UNIFIED STANDARD SCREW THREAD SERIES UNLESS OTHERWISE SPECIFIED.

3025242



NOTES:

1. VAPOR DEGREASE ALL PARTS BEFORE BRAZING
2. BRAZE @ 1020°C FOR 15 MIN. IN LINE HYDROGEN. USE FIXT. #3025254

TOLERANCES AND WORKMANSHIP REQUIREMENTS NOT SPECIFIED ON THIS DRAWING SHALL CONFORM TO SPECIFICATION 93650.

BASIC DIMENSIONS	2 PLACE DECIMALS	3 PLACE DECIMALS
UP THRU 6		
6 THRU 24		
ABOVE 24		
ANGULAR DIMENSIONS		

RCA — RCA CORPORATION

CATHODE BODY SUBASS'Y

FIRST MADE FOR — USED ON

DRAWN BY W. T. BURKINS

DESIGNED BY

CHECKED BY

COMMODITY CODE

A SIZE — 302 5242

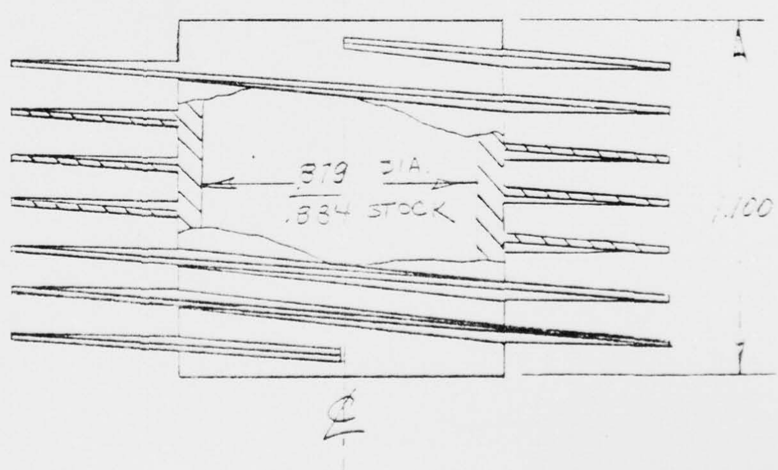
CODE IDENT NO. 49671 — SHEET — CONT'D ON SH

REVISIONS	
. BY	0
DATE	

DIMENSIONS ARE IN INCHES AND INCLUDE THICKNESS OF PLATING. DO NOT SCALE DRAWING. ALL EXTERNAL THREADS TO BE CLASS 2A BEFORE PLATING AND NOT GREATER THAN THE MAXIMUM SIZE OF CLASS 3A AFTER PLATING. ALL INTERNAL THREADS TO BE CLASS 2B UNLESS OTHERWISE SPECIFIED. ALL THREADS TO BE UNIFIED STANDARD SCREW THREAD SERIES UNLESS OTHERWISE SPECIFIED.

MATERIAL: 61-071H065-01 WOLVERINE COPPER TRUFIN TYPE H/A TUBING - EXTRUDED WITH 7 FINS PER INCH RANDOM LENGTHS UP TO 20 FEET LONG

NOTE: TRIM OFF APPROXIMATELY EQUAL AMOUNTS OF THE FEATHERED EDGE OF THE FINS FROM THE PARTING OPERATION SO THAT THERE IS A MINIMUM OF 7 FULL FINS. THE TRIMMING IS DONE BY CUTTING ALONG A RADIUS AND ALIGNING THE CUT AT EACH END TO LIE IN THE SAME PLANE.



TOLERANCES AND WORKMANSHIP REQUIREMENTS NOT SPECIFIED ON THIS DRAWING SHALL CONFORM TO SPECIFICATION 93650.

BASIC DIMENSIONS	2 PLACE DECIMALS	3 PLACE DECIMALS
UP THRU 5		
6 THRU 24		
ABOVE 24		
ANGULAR DIMENSIONS		

RCA — RCA CORPORATION

FINNED TUBING

FIRST MADE FOR — USED ON

DRAWN BY [signature] 4/2/76

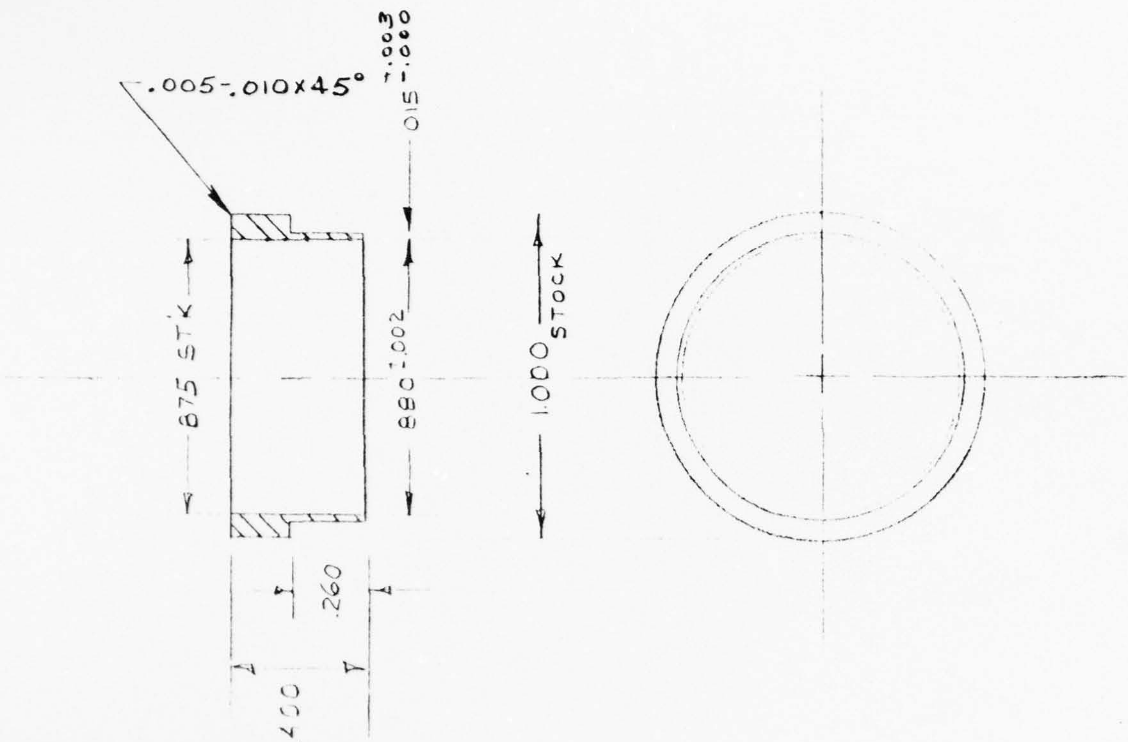
DESIGNED BY

CHECKED BY

COMMODITY CODE

A SIZE — 302 5247

CODE IDENT NO. 49671 — SHEET — CONT'D ON SH



CHECKED BY	
APPROVED BY	0
Changed .015 +.005 -.000 to .015 +.003 -.000 WJ Burkins 5-3-76	1
Changed .410 to .400 WJ Burkins 7-12-76	2
ADDED .005-.010 x 45°; .015 WAS +.005 -.000 R. Miles Sept. 17, 1976	3

STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A; INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.

SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED.

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

MATERIAL: 1.000 X .875 X .500 OFHC COPPER TUBING

PATTERN NO.: C 100T

SCALE:

USED ON:

DWG TITLE: ANGLE STRAIN ISOLATION SLEEVE

DESIGN BY:

MODEL NO.:

RCA Electronic Components — EQUIPMENT DEVELOPMENT

DRAWN BY: W T BURKINS

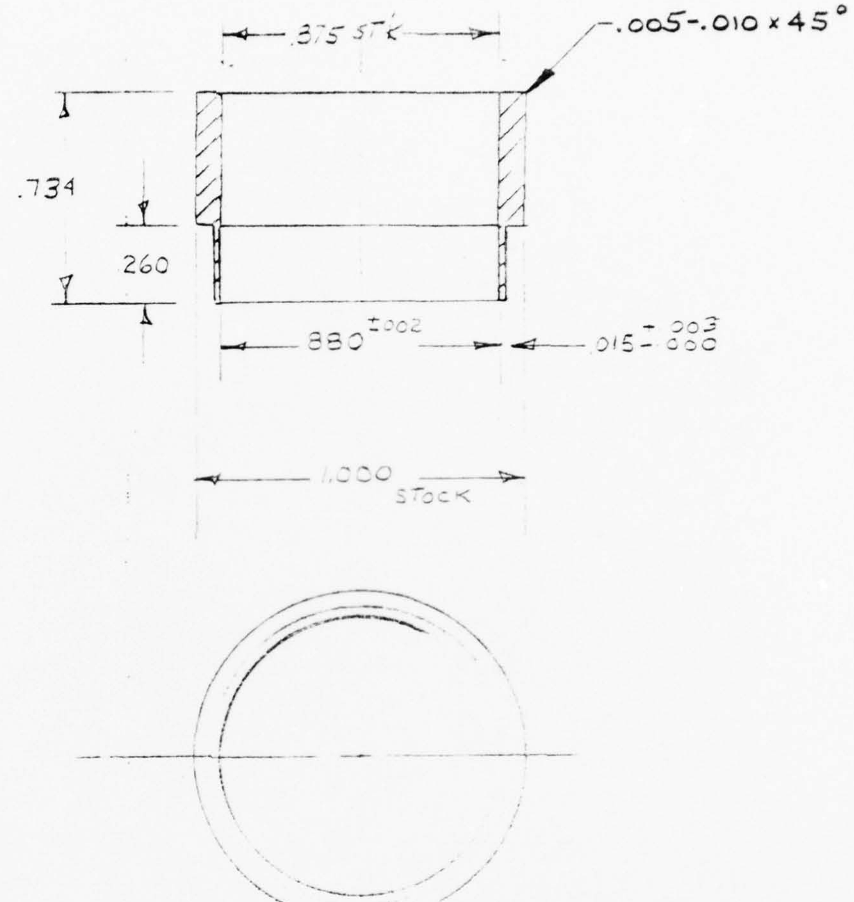
SIZE: A

DWG. NO. 302 5248R3

REVISIONS	
BY	0
DATE	
changed .015 $^{+.005}_{-.000}$ to .015 $^{+.003}_{-.000}$ W.J.B. 5-3-76	1
changed .744 to .734 W.J. Burkins 7-12-76	2
ADDED .005-.010×45° Miles Sept. 17, 1976	3

DIMENSIONS ARE IN INCHES AND INCLUDE THICKNESS OF PLATING. DO NOT SCALE DRAWING. ALL EXTERNAL THREADS TO BE CLASS 2A BEFORE PLATING AND NOT GREATER THAN THE MAXIMUM SIZE OF CLASS 3A AFTER PLATING. ALL INTERNAL THREADS TO BE CLASS 2B UNLESS OTHERWISE SPECIFIED. ALL THREADS TO BE UNIFIED STANDARD SCREW THREAD SERIES UNLESS OTHERWISE SPECIFIED.

3025249R3



1.000 × .875 × .875 C-600T
MAT: OFHC COPPER TUBING

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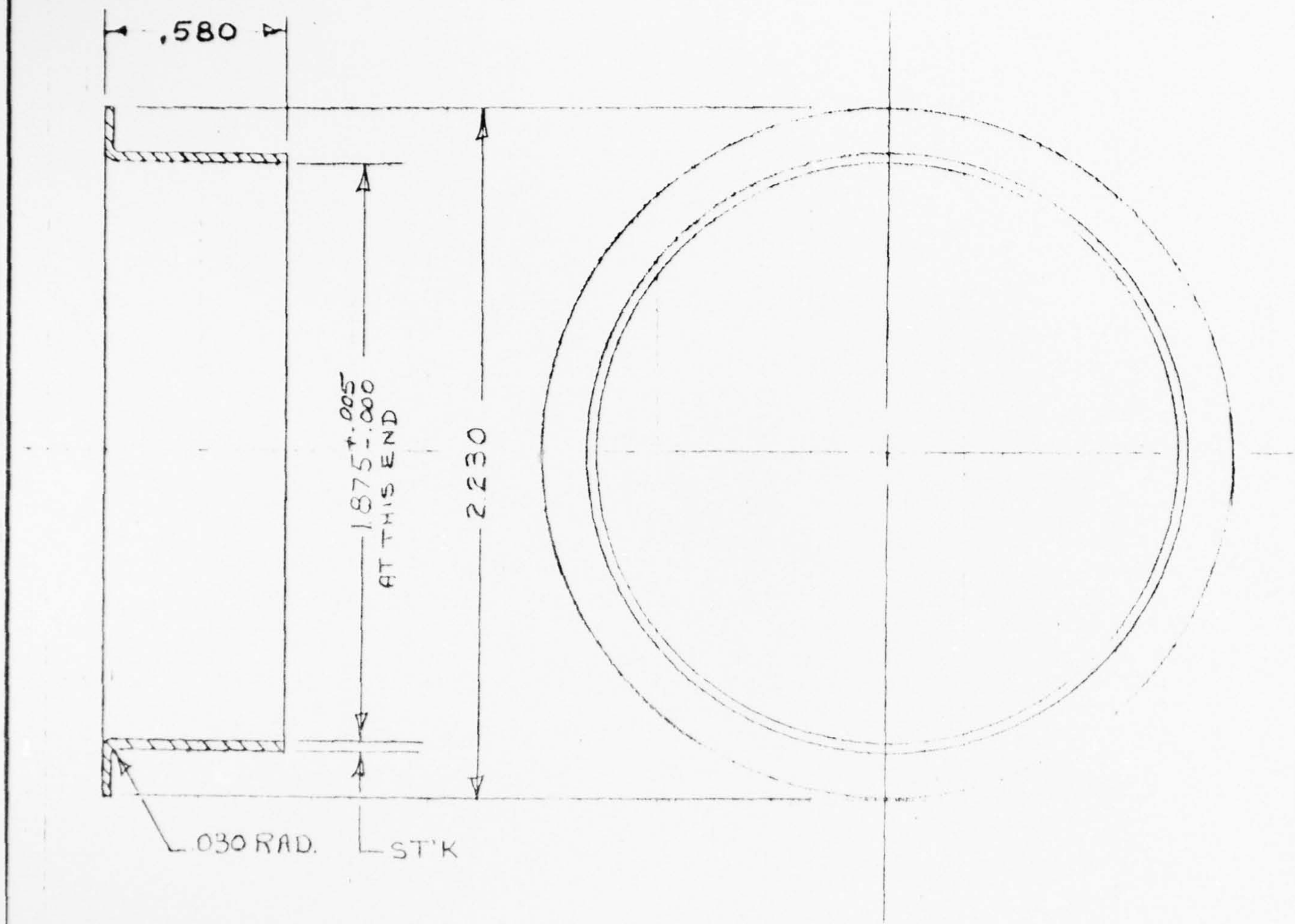
	BASIC DIMENSIONS	2 PLACE DECIMALS	3 PLACE DECIMALS
	UP THRU 6		
	6 THRU 24		
	ABOVE 24		
	ANGULAR DIMENSIONS		

RCA — RCA CORPORATION	
CATHODE STRAIN ISOLATION SLEEVE	
FIRST MADE FOR	USED ON
DRAWN BY W.J. BURKINS	
DESIGNED BY	
CHECKED BY	
COMMODITY CODE	
A SIZE	3025249R3
CODE IDENT NO. 49671	SHEET / CONT'D ON SH



CHECKED BY

APPROVED BY

.580 WAS .600 R. Milan Sept. 7, 1976	1
	0

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STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A; INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED

SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

MATERIAL: C1010 - .030 TH'K C.R.S.

PATTERN NO. | SCALE | USED ON

RCA Electronic Components — EQUIPMENT DEVELOPMENT

DWG. TITLE: WELD RING

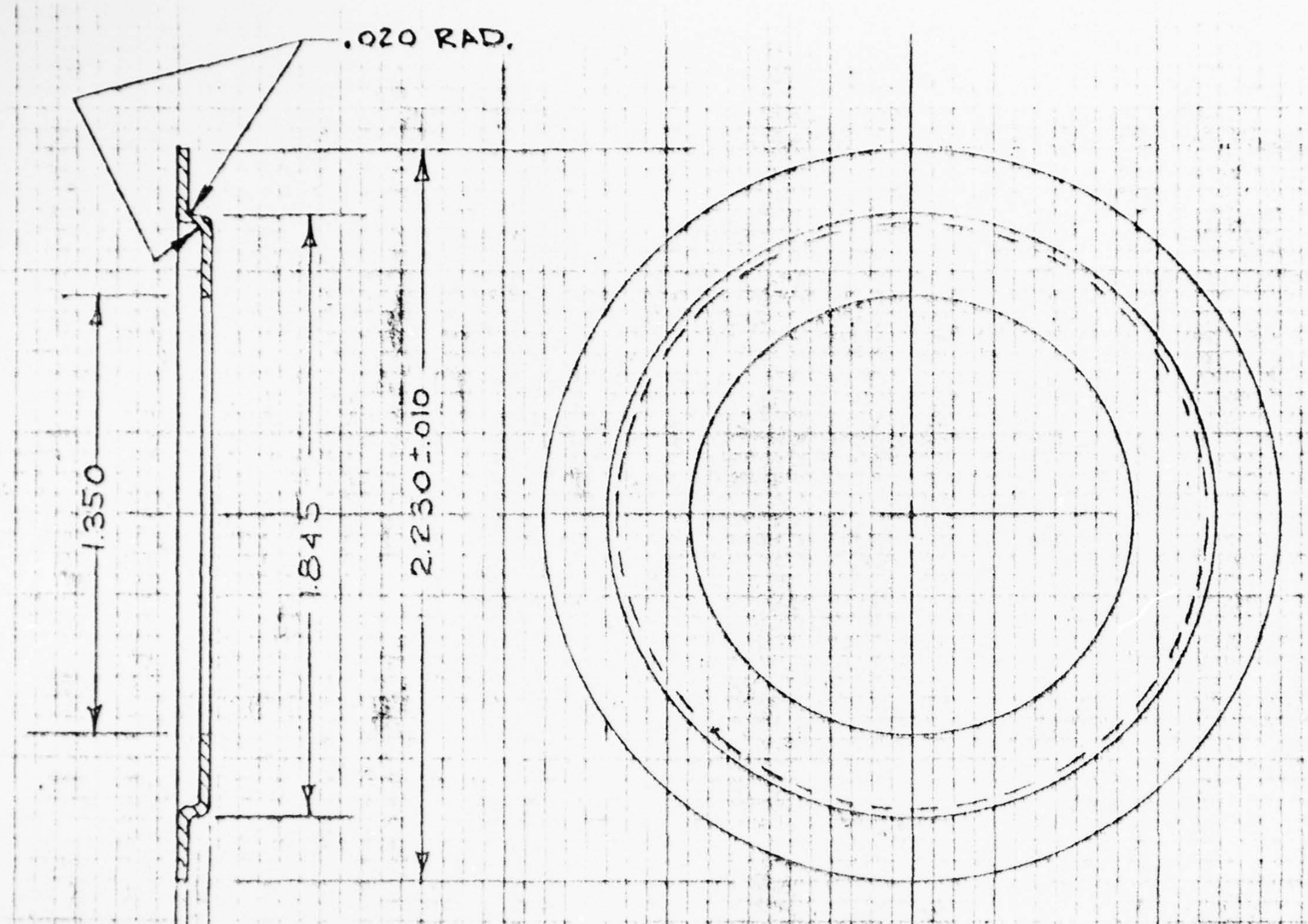
DESIGN BY: W. J. Burkins

DRAWN BY

MODEL NO.: J15371C

SIZE: A

DWG. NO.: 302-5258R1



NOTES:

1. FIRE IN LINE HYDROGEN FOR 30 MIN. @ 900°C & @ 1100°C FOR 10-20 MIN. (AT RCA)

CHECKED BY	
APPROVED BY	0
ADDED .020 RAD.; MAT'L WAS .020; ADDED FIRING NOTE; NOTE WAS: ALL BEND RADII EQUAL TO MAT'L TH'K R. Miller Oct. 5, 1976	1

STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A; INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.

SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED.

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

MATERIAL: KOVAR .030 TH'K

PATTERN NO. | SCALE | USED ON

DWG. TITLE: CATHODE WELD FLANGE

DESIGN BY

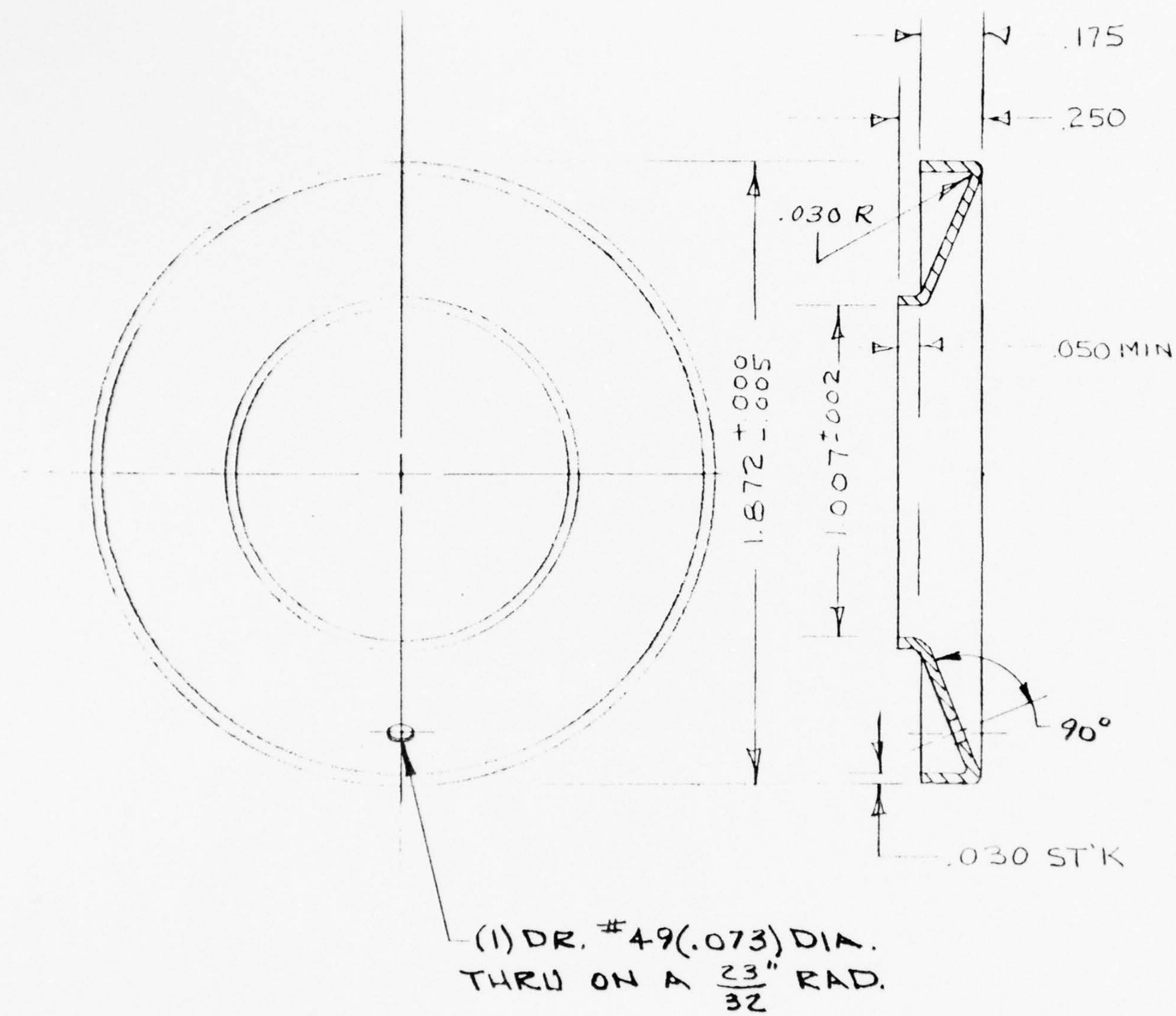
MODEL NO. J15371C

DRAWN BY: W.J. Burkins

RCA Electronic Components — EQUIPMENT DEVELOPMENT

SIZE A — DWG. NO. 302-5259R1

659 8-69



CHECKED BY	
APPROVED BY	0
ADDED #49 HOLE R. Miles 9/8/76	1

STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED

SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

MATERIAL: C1010-CRS S-10E2

PATTERN NO | SCALE: 2:1 | USED ON

RCA Electronic Components — EQUIPMENT DEVELOPMENT

DWG. TITLE: ANODE WELD FLANGE

DESIGN BY

MODEL NO: J153710

DRAWN BY: W J Rudkin

SIZE: A

DWG NO: 302-5260R1

REVISIONS

CHECKED BY

APPROVED BY

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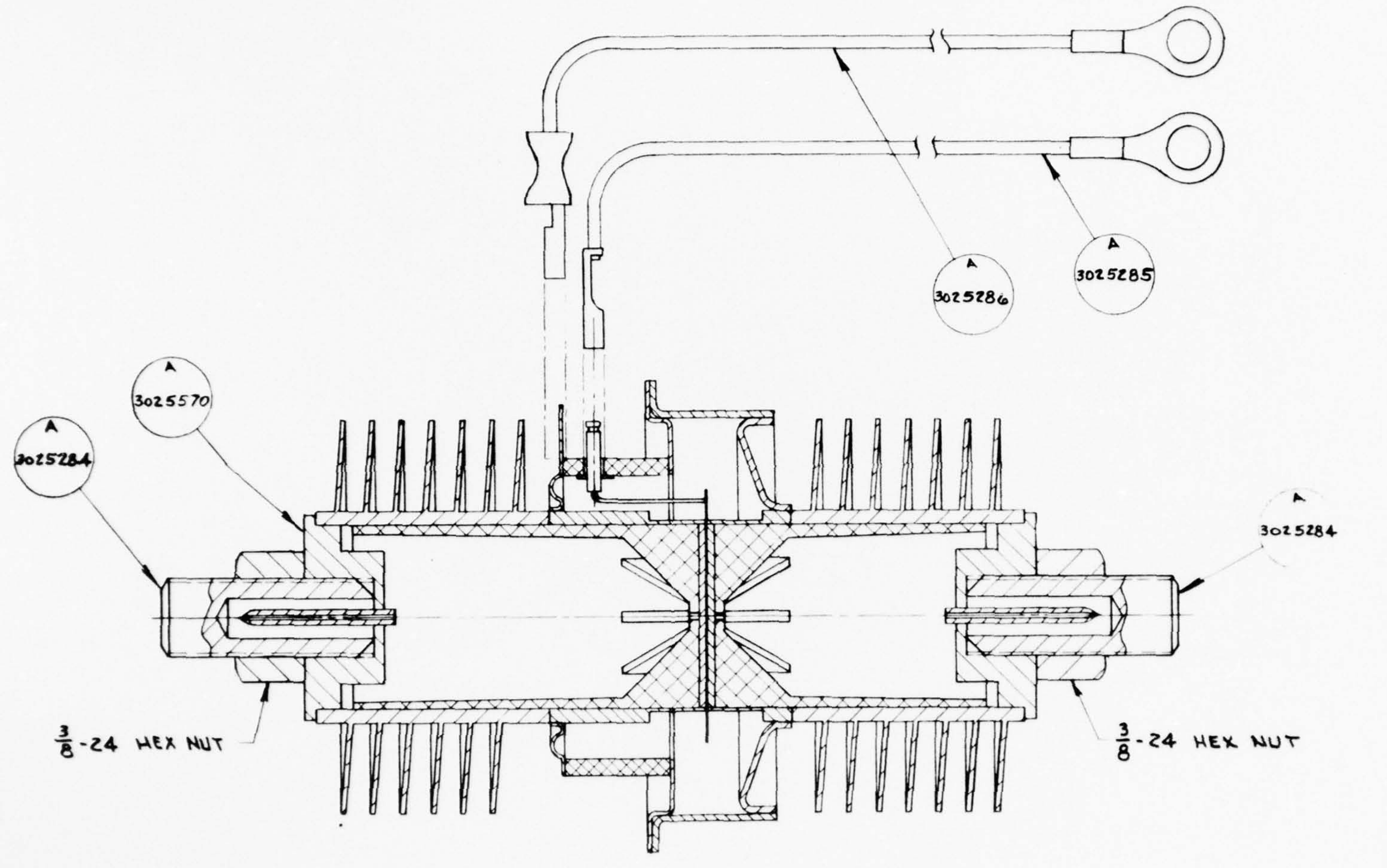

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STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM.	±	1/2°	

NOTE: THREADS EXTERNAL, CLASS 2A; INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.

SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED.

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

MATERIAL: CH

PATTERN NO.

SCALE: 2:1

USED ON

RADIO CORPORATION OF AMERICA

~~EQUIPMENT DEVELOPMENT~~

DWG. TITLE: TRANSCALENT THYRISTOR ASS'Y

DESIGN BY

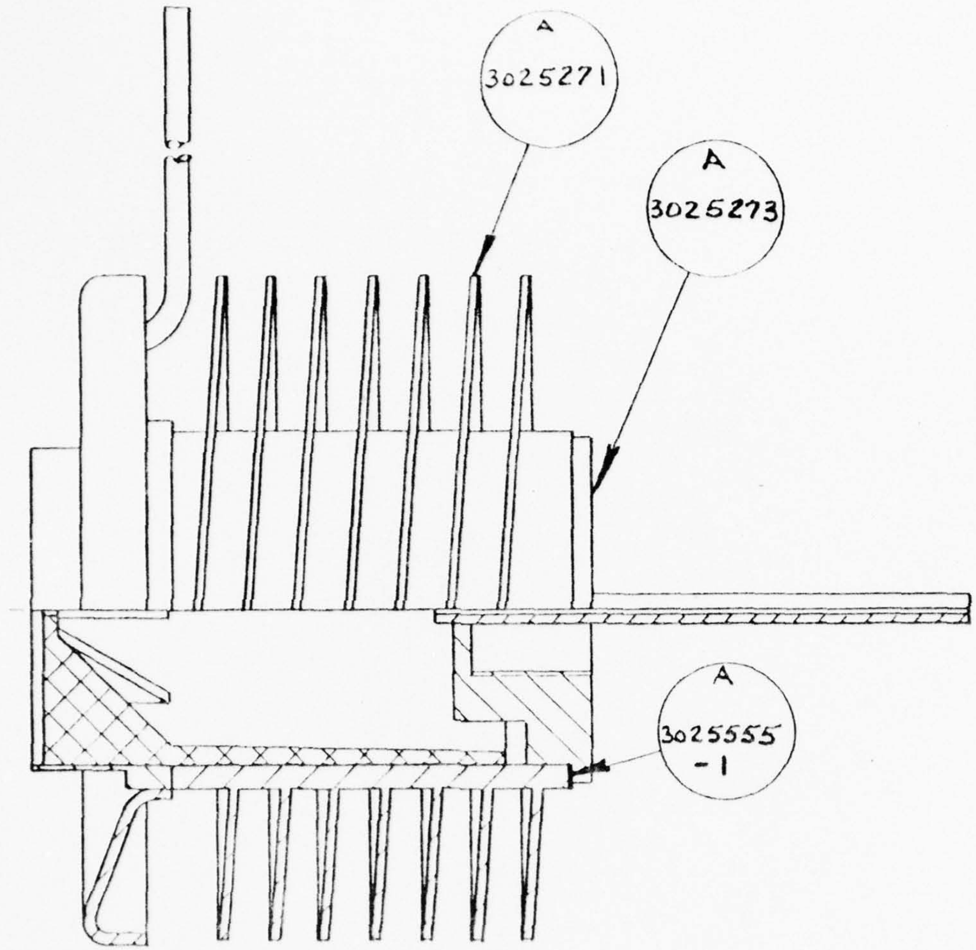
MODEL NO. J15371C

DRAWN BY: R. Miles Aug. 12, 1976

B SIZE — DWG. NO. 3025268

T 660 12/56

DEFIANCE NO. 1020F-8 470



SHEET 1 OF 2

STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.

SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED.

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

MATERIAL:

PATTERN NO.: — SCALE: 2:1 — USED ON:

RCA Electronic Components — EQUIPMENT DEVELOPMENT

DWG. TITLE: ANODE HEAT PIPE ASS'Y

DESIGN BY:

DRAWN BY: R. Miles Aug. 26, 1976

MODEL NO. J15371C

SIZE A — DWG. NO. 3025269

CHECKED BY

APPROVED BY

0

CHECKED BY

APPROVED BY

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NOTES:

1. BRAZE IN LINE HYDROGEN-PREHEAT IN VESTIBULE OF FURNACE FOR 15 MIN.; BRAZE @ 760°C FOR 20 MIN.; SET ASS'Y ON 3025232 FOR BRAZING
2. HELIUM LEAK CHECK; BACK FILL WITH NITROGEN & PINCH-OFF LONG
3. HAND LAP MOLY DISC END OF HEAT PIPE FLAT USING ALUM. OXIDE CARBORUNDUM 220 GRIT & 50% BENDIX 25 I CLEANER CONCENTRATE & 50% WATER AS A VEHICLE
4. ULTRASONIC WASH & RINSE & NICKEL PLATE ENTIRE ASS'Y USING SCHED. N-2 FOR 12 MIN. @ 2 AMPS. USE MULTIPLE CLIPS TO GATE TERMINAL & TO WELD FLANGE. MOVE CLIPS TO NEW SITES @ 1/2 THE PLATING TIME.
5. PLATE CHECK FOR BLISTERS IN HYDROGEN @ 600°C FOR 10 MIN.

SHEET 2 OF 2

STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED

SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED.

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

MATERIAL: CH

PATTERN NO | SCALE: CH | USED ON

RCA Electronic Components EQUIPMENT DEVELOPMENT

DWG. TITLE: ANODE HEAT PIPE ASS'Y

DESIGN BY

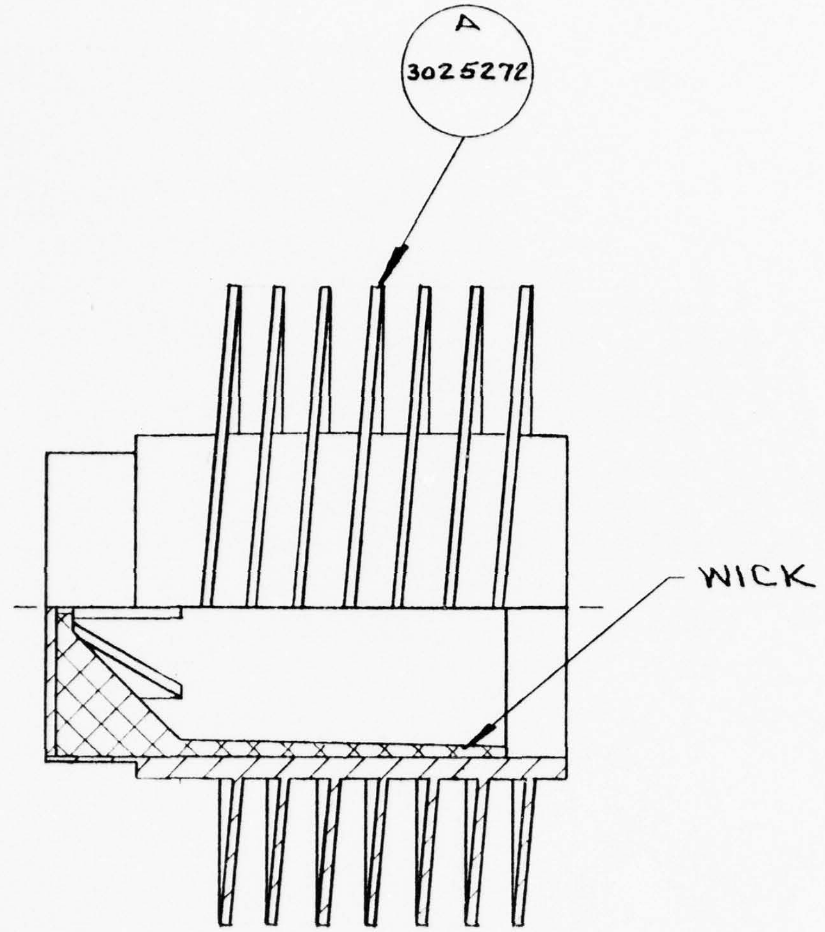
MODEL NO. J15371C

DRAWN BY: R. Milo Oct. 5, 1976

SIZE: A

DWG NO: 3025269

REVISIONS	
CHECKED BY	
APPROVED BY	0



NOTES:
1. COP PLATE INSIDE SURFACE OF PT.#C3025203 PER SCHED. C-1 USING FIXT. #C3025557

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STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM. ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A; INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.

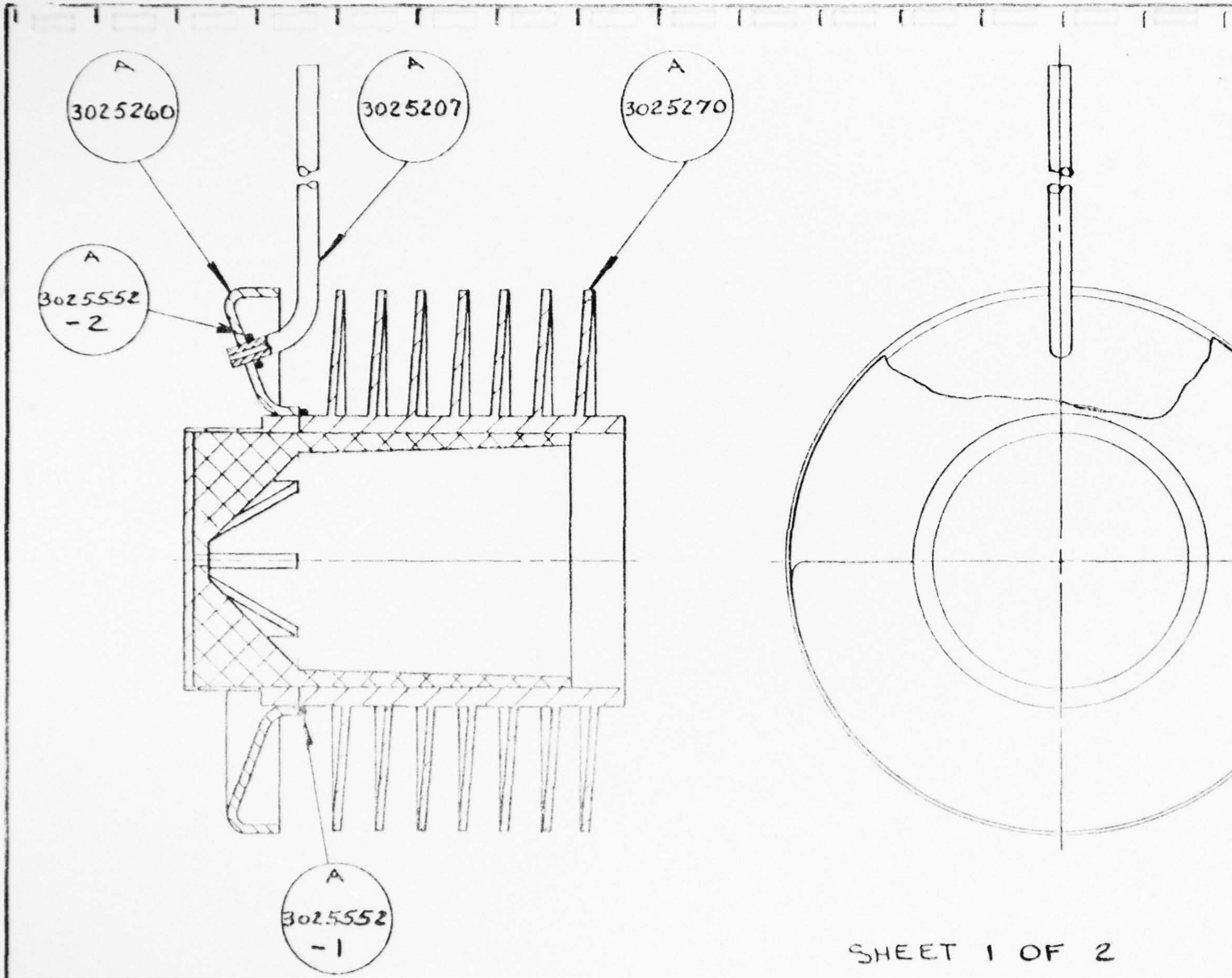
SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED.

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

MATERIAL			DWG. TITLE ANODE BODY SUB-ASS'Y (WICKED)	
PATTERN NO.	SCALE 2:1	USED ON	DESIGN BY	MODEL NO. J15371C
RCA Electronic Components ~~EQUIPMENT DEVELOPMENT~~			DRAWN BY R. Miles Aug. 13, 1976	SIZE A DWG. NO. 3025270

BRUNING 40-22 11838

T659 8/69



SHEET 1 OF 2

STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A; INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.

SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED.

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

MATERIAL: CH

PATTERN NO.

SCALE: 2:1

USED ON

RCA Electronic Components — EQUIPMENT DEVELOPMENT

DWG TITLE: ANODE BODY

DESIGN BY

MODEL NO: J15371C

DRAWN BY: R. Miles Aug. 13, 19X

SIZE: A

DWG NO: 3025271

CHECKED BY

APPROVED BY

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APPROVED BY

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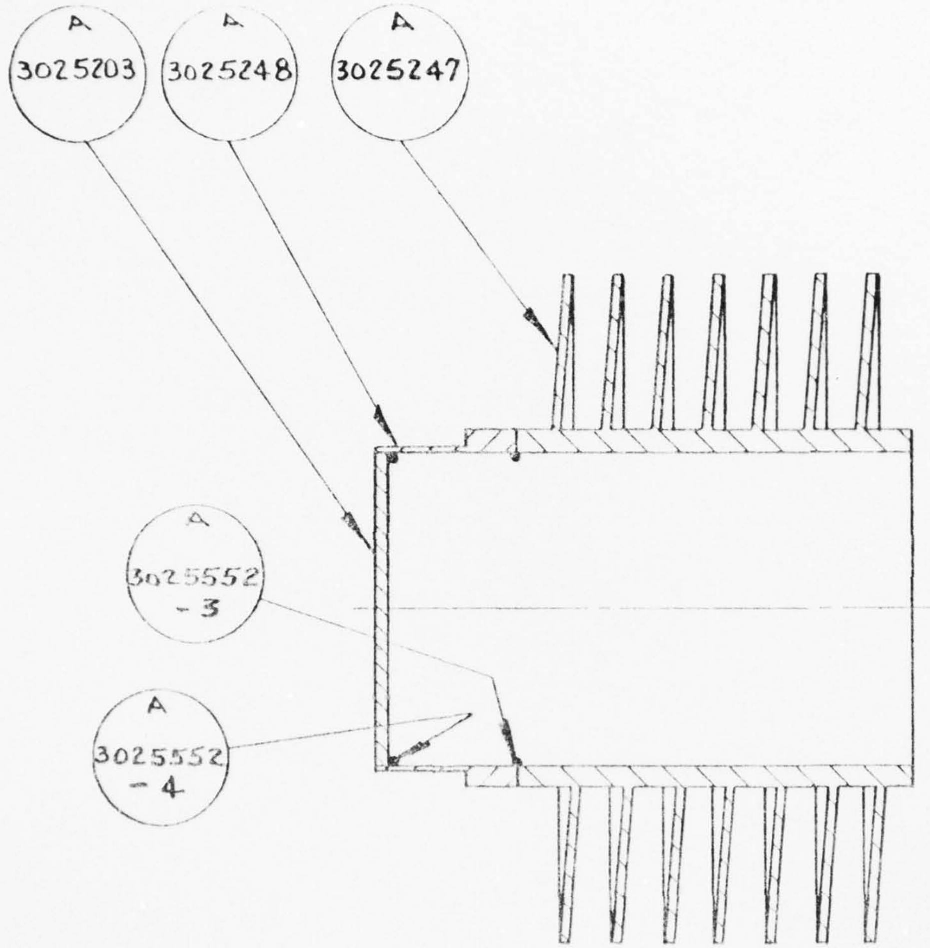
NOTES:

1. BRAZE IN LINE HYDROGEN @ 830°C FOR 15 MIN. USE FIXT. #3025287
2. TRIM WICK TO LENGTH USING TOOL #3025296
3. HAND BEND PT. #3025207 TO CONTOUR SHOWN

SHEET 2 OF 2

STANDARD TOLERANCE				NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED	MATERIAL			DWG. TITLE ANODE BODY	
BASIC DIM		FRAC	DEC						
UP TO 6"	±	1/64	.005	SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED	PATTERN NO	SCALE	USED ON	DESIGN BY	MODEL NO. J15371C
ABOVE 6"	±	1/32	.010						
ABOVE 24"	±	1/16	.015	NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS,	RCA EQUIPMENT DEVELOPMENT			DRAWN BY	A DWG. NO.



NOTES:

1. BRAZE @ 1020°C FOR 15 MIN. IN LINE HYDROGEN. USE FIXT. # 3025254
2. VAPOR DEGREASE ALL PARTS BEFORE BRAZING

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STANDARD TOLERANCE				NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED	MATERIAL CH			DWG. TITLE ANODE BODY SUB-ASS'Y	
BASIC DIM		FRAC	DEC						
UP TO 6"	±	1/64	.005	SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED	PATTERN NO	SCALE 2:1	USED ON	DESIGN BY	MODEL NO J15371C
ABOVE 6"	±	1/32	.010						
ABOVE 24"	±	1/16	.015	NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS	RCA Electronic EQUIPMENT DEVELOPMENT			DRAWN BY	A DWG. NO. 302 5272

AD-A038 429 RCA CORP LANCASTER PA SSD-ELECTRO-OPTICS AND DEVICES F/G 9/1
MANUFACTURING METHODS AND TECHNOLOGY (MM AND T) MEASURE FOR FAB--ETC(U)
JAN 77 S W KESSLER, A W MANNON, R E REED DAAB07-76-C-8120

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2 OF 2
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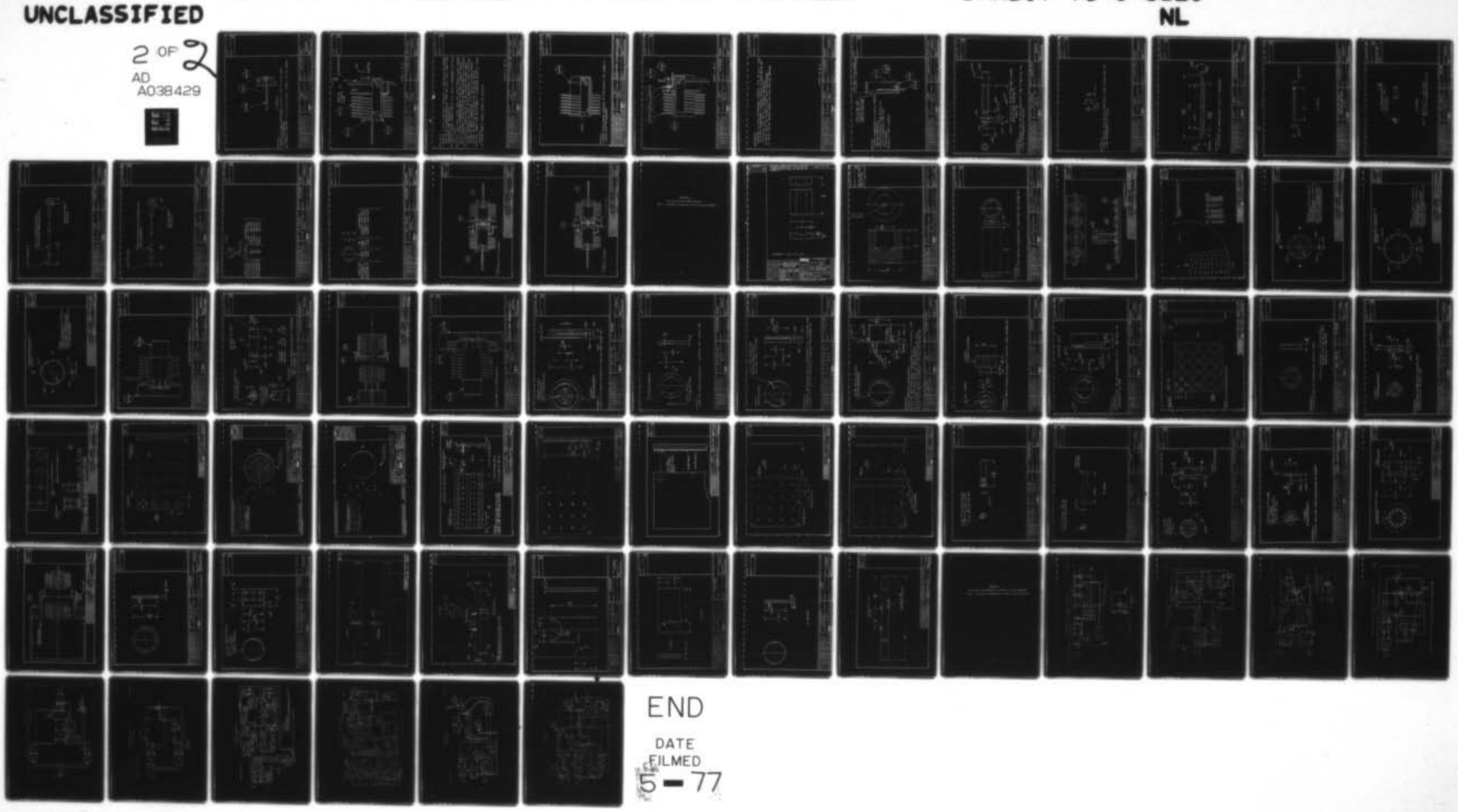

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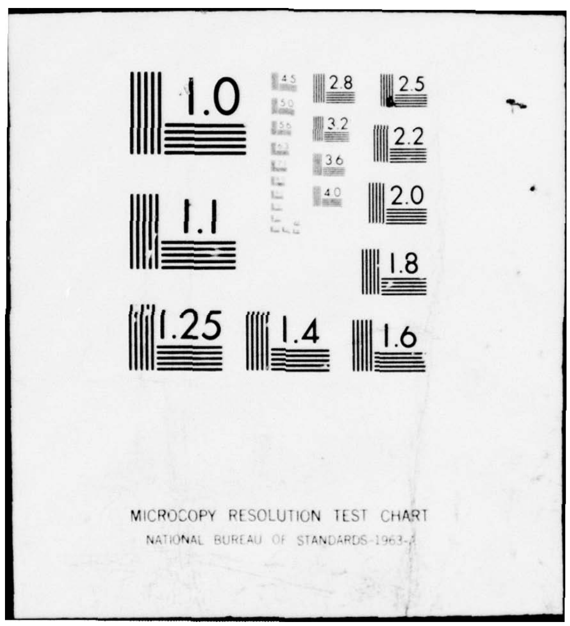
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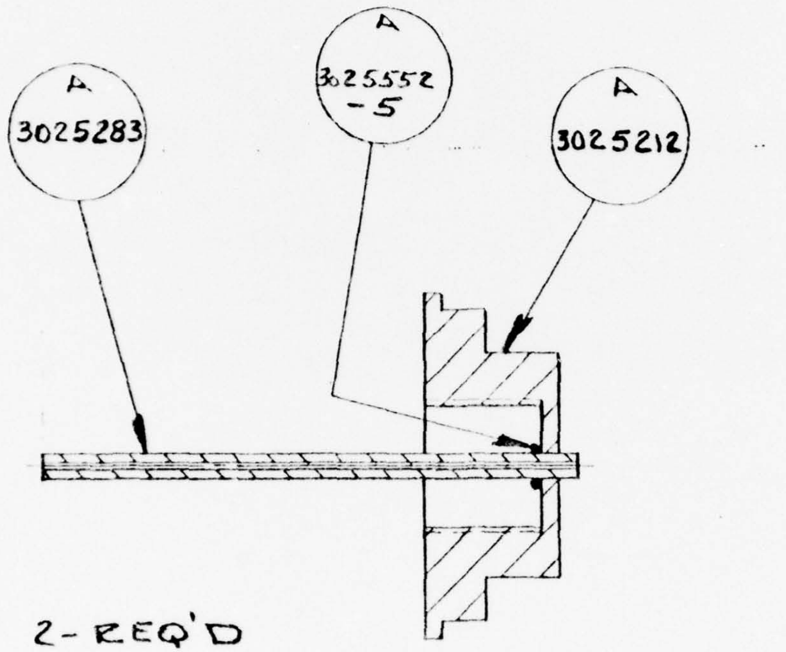
NATIONAL BUREAU OF STANDARDS-1963-A



2-REQ'D

NOTES:

1. BRAZE IN LINE HYDROGEN @ 830°C FOR 15 MIN. USE
   FIXT. #3025558
2. INSPECT BRAZE FOR FLOW & THAT TUBE I.D. IS OPEN

CHECKED BY

APPROVED BY

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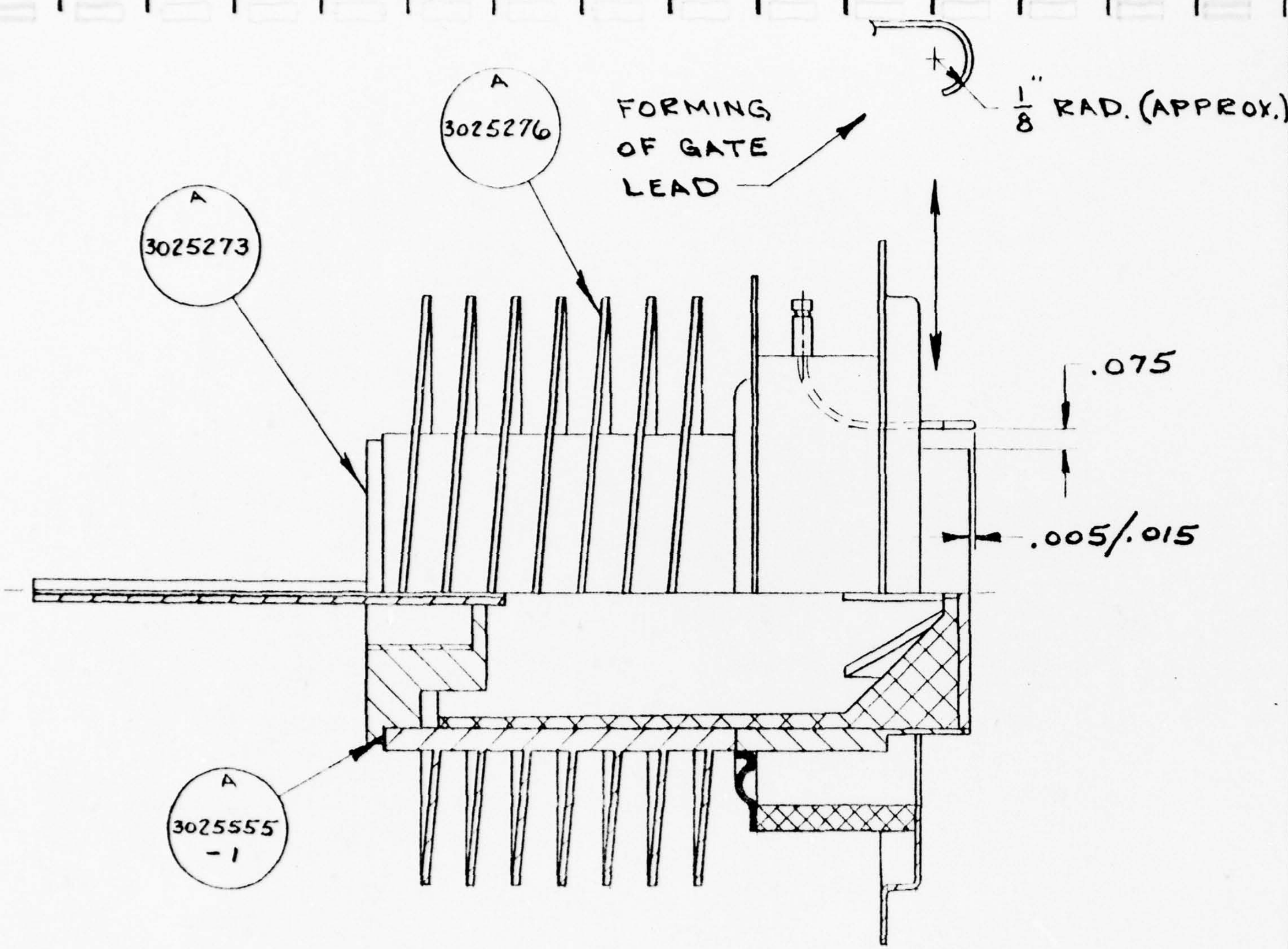

SHEET 1 OF 2

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APPROVED BY	0

STANDARD TOLERANCE				NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.	MATERIAL			DWG. TITLE CATHODE HEAT PIPE ASS'Y
BASIC DIM		FRAC	DEC					
UP TO 6"	±	1/64	.005	SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED	PATTERN NO.	SCALE 2:1	USED ON	DESIGN BY
ABOVE 6"	±	1/32	.010					MODEL NO. J15371C
ABOVE 24"	±	1/16	.015	NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.	RCA Electronic Components EQUIPMENT DEVELOPMENT			DRAWN BY R. Mules, Aug. 27, 1976
ANGULAR DIM ± 1/2°								SIZE A DWG. NO. 3025274

NOTES:

1. BRAZE IN LINE HYDROGEN - PREHEAT IN VESTIBULE OF FURNACE FOR 15 MIN.; BRAZE @ 760°C FOR 20 MIN.; SET ASS'Y ON 3025232 FOR BRAZING
2. HELIUM LEAK CHECK; BACK FILL WITH NITROGEN & PINCH-OFF LONG
3. HAND LAP MOLY DISC END OF HEAT PIPE FLAT USING ALUM. OXIDE CARBORUNDUM 220 GRIT & 50% BENDIX 25 I CLEANER CONCENTRATE & 50% WATER AS A VEHICLE
4. ULTRASONIC WASH & RINSE & NICKEL PLATE ENTIRE ASS'Y USING SCHED. N-2 FOR 12 MIN. @ 2 AMPS. USE MULTIPLE CLIPS TO GATE TERMINAL & TO WELD FLANGE. MOVE CLIPS TO NEW SITES @ 1/2 THE PLATING TIME
5. PLATE CHECK FOR BLISTERS IN HYDROGEN @ 600°C FOR 10 MIN.
6. HAND FORM GATE LEAD AS SHOWN

SHEET 2 OF 2

CHECKED BY	APPROVED BY	
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STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE. THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.

SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED.

NOTE. SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART

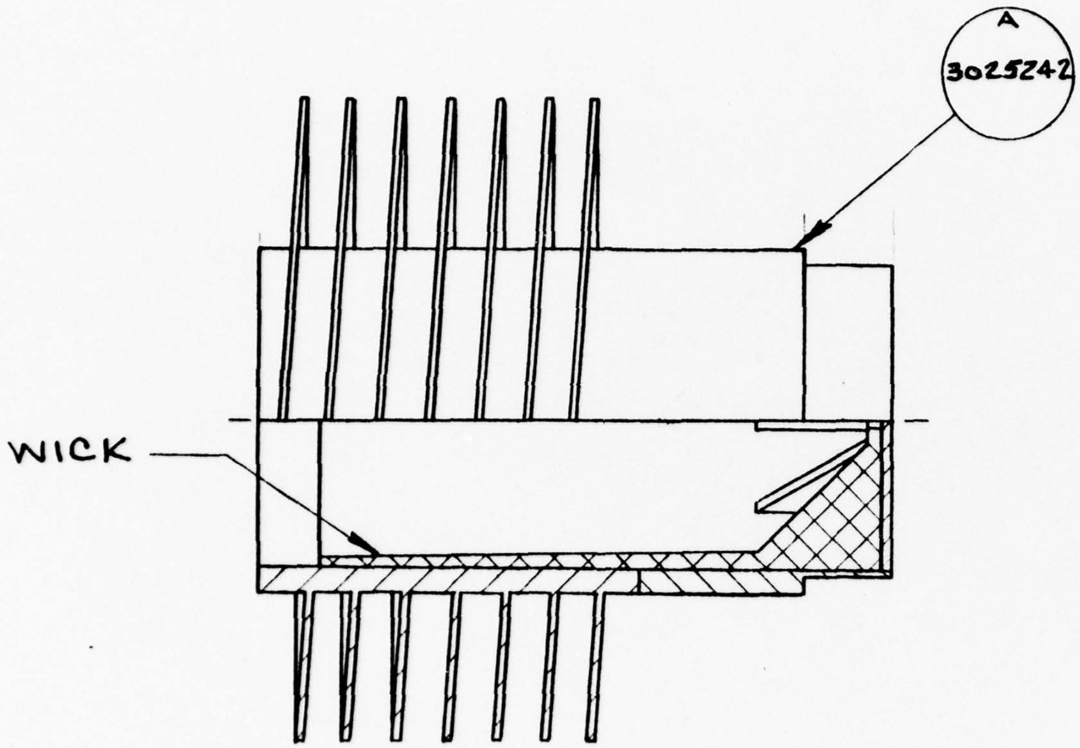
MATERIAL	DWG TITLE
	CATHODE HEAT PIPE ASS'Y

PATTERN NO.	SCALE	USED ON	DESIGN BY	MODEL NO.
				J15371C

RCA Electronic Components — EQUIPMENT DEVELOPMENT

DRAWN BY	SIZE	DWG NO.
R. Miley Oct. 5, 1976	A	3025274

REVISIONS	
CHECKED BY	
APPROVED BY	0



NOTES:

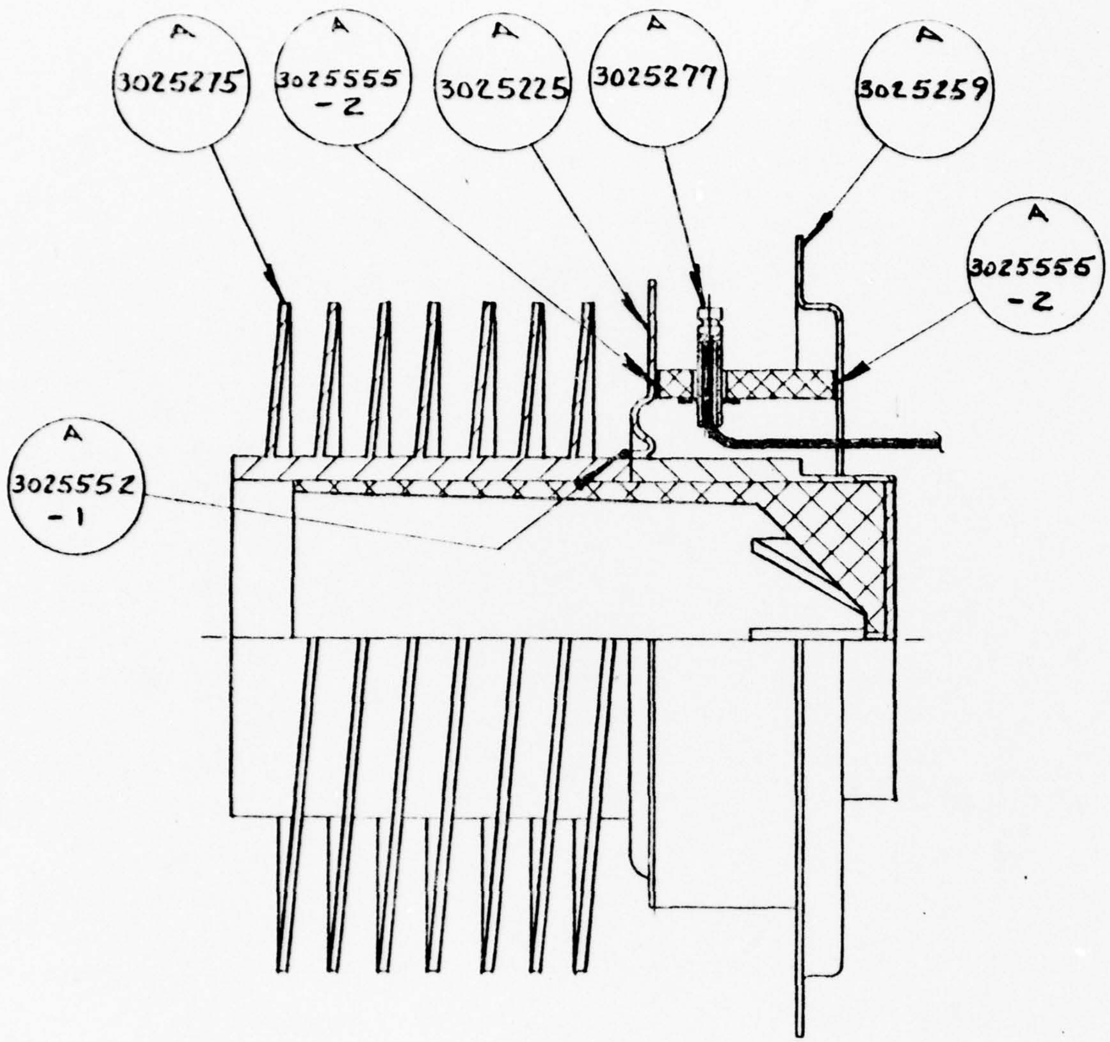
1. COPPER PLATE INSIDE SURFACE OF PT. #C3025203 PER SCHED. C-1 USING FIXT. #C3025557

STANDARD TOLERANCE				
BASIC DIM		FRAC	DEC.	NOTE: THREADS EXTERNAL, CLASS 2A; INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.
UP TO 6"	±	1/64	.005	SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED.
ABOVE 6"	±	1/32	.010	
ABOVE 24"	±	1/16	.015	NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.
ANGULAR DIM. ± 1/2°				

MATERIAL			DWG. TITLE	
H			CATHODE BODY SUB-ASS'Y (WICKED)	
PATTERN NO.	SCALE 2:1	USED ON	DESIGN BY	MODEL NO. J15371C
RCA Electronic Components ~~EQUIPMENT DEVELOPMENT~~			DRAWN BY R. Miles Aug. 27, 1976	SIZE A · DWG. NO. 3025275

BRUNING 40-22 11838

T659 8/69



SHEET 1 OF 2

STANDARD TOLERANCE							
BASIC DIM		FRAC	DEC	NOTE: THREADS EXTERNAL, CLASS 2A; INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED	MATERIAL		DWG. TITLE CATHODE BODY
UP TO 6"	±	1/64	.005	SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED	PATTERN NO.	SCALE 2:1 / USED ON	DESIGN BY / MODEL NO J15371C
ABOVE 6"	±	1/32	.010				
ABOVE 24"	±	1/16	.015	NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS RIVETS, WASHERS, DOWELS, TAPER PINS COTTER PINS & WOODRUFF KEYS WITH PART	RCA Electronic Components EQUIPMENT DEVELOPMENT		DRAWN BY R. Miles Aug 26, 1976 / SIZE A / DWG NO. 3025276
ANGULAR DIM ± 1/2°							

CHECKED BY

APPROVED BY

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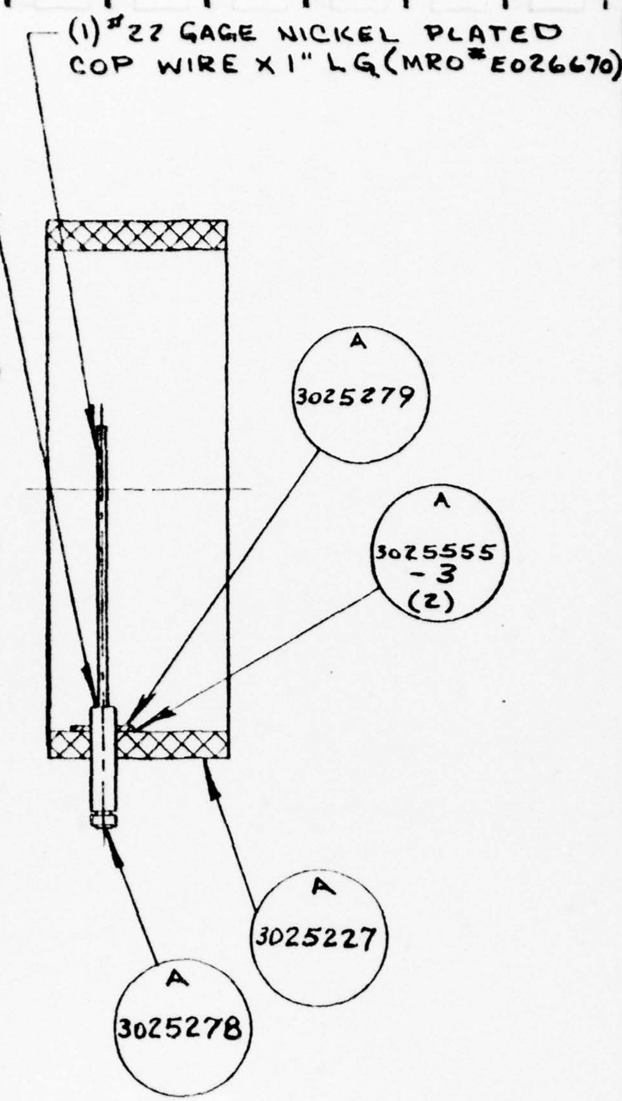
CHECKED BY	
APPROVED BY	0

NOTES co

1. BRAZE IN LINE HYDROGEN @ 830°C FOR 15 MIN. - USE FIXTURE #3025290. - PREHEAT PARTS IN VESTIBULE OF FURNACE FOR 15 MIN. BEFORE BRAZING
2. TRIM WICK TO LENGTH. USE TOOL #3025296
3. BEND INSIDE GATE WIRE OUT OF WAY OF BRAZE

SHEET 2 OF 2

STANDARD TOLERANCE				NOTE	MATERIAL			DWG. TITLE	
BASIC DIM		FRAC	DEC	NOTE. THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED	MATERIAL CH			DWG. TITLE CATHODE BODY	
UP TO 6"	±	1/64	.005	SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED	PATTERN NO.	SCALE CH	USED ON	DESIGN BY	MODEL NO. J15371C
ABOVE 6"	±	1/32	.010						
ABOVE 24"	±	1/16	.015	NOTE. SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.	RCA Electronic Components EQUIPMENT DEVELOPMENT			DRAWN BY A. Niles Oct. 5, 1976	SIZE A DWG. NO. 3025276
ANGULAR DIM ± 1/2°									



NOTES:

1. VAPOR DEGREASE ALL METAL PARTS BEFORE BRAZING
2. BRAZE @ 1020°C FOR 15 MIN. IN LINE HYDROGEN. USE FIXT. #3025556
3. HELIUM LEAK CHECK

CHECKED BY	
APPROVED BY	0

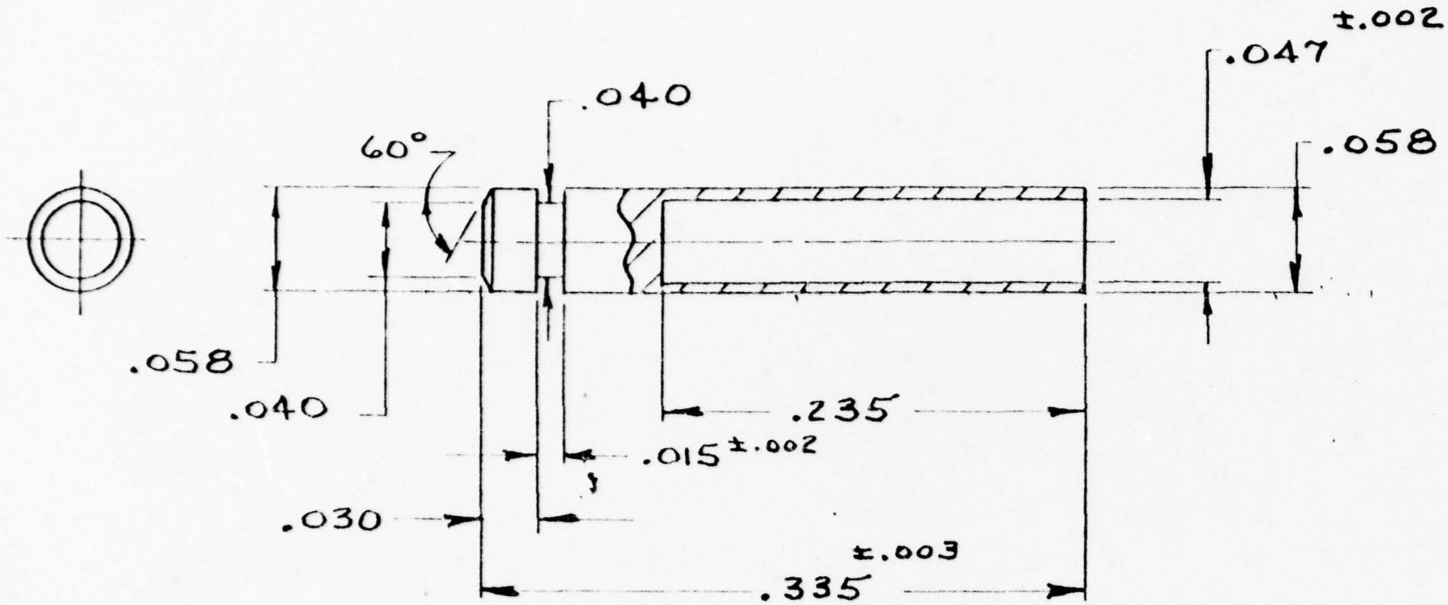
STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED

SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

MATERIAL			DWG. TITLE CERAMIC INSULATOR ASS'Y	
PATTERN NO.	SCALE 2:1	USED ON	DESIGN BY	MODEL NO. J15371C
RCA Electronic Components EQUIPMENT DEVELOPMENT			DRAWN BY R. Miles Aug. 27, 1976	A SIZE DWG. NO 3025277



MAT'L: TURNMATIC PART # 32.0531-KOVAR
(DIM.'S ARE VENDOR'S
SPEC.'S)

NOTES:
1. FIRE @ 900°C FOR 30 MIN. & @ 1100°C FOR 10-20 MIN. IN LINE HYDROGEN (AT RCA)

CHECKED BY		
APPROVED BY		0

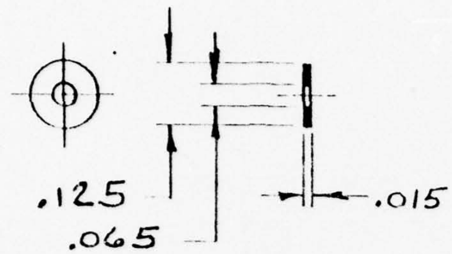
STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED

SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART

MATERIAL	SEE ABOVE
DWG. TITLE	GATE PIN
PATTERN NO.	
SCALE	10:1
USED ON	
DESIGN BY	
MODEL NO.	J15371C
RCA Electronic Components	EQUIPMENT DEVELOPMENT
DRAWN BY	R. Miles Aug. 27, 1976
SIZE	A
DWG. NO.	3025278



NOTES:

1. FIRE @ 900°C FOR 30 MIN. & @ 1100°C FOR 10-20 MIN. IN LINE HYDROGEN (AT RCA)

CHECKED BY	
APPROVED BY	0

STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.

SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED.

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART

MATERIAL: KOVAR

DWG. TITLE: GATE PIN WASHER

PATTERN NO.:

SCALE: 2:1

USED ON:

DESIGN BY:

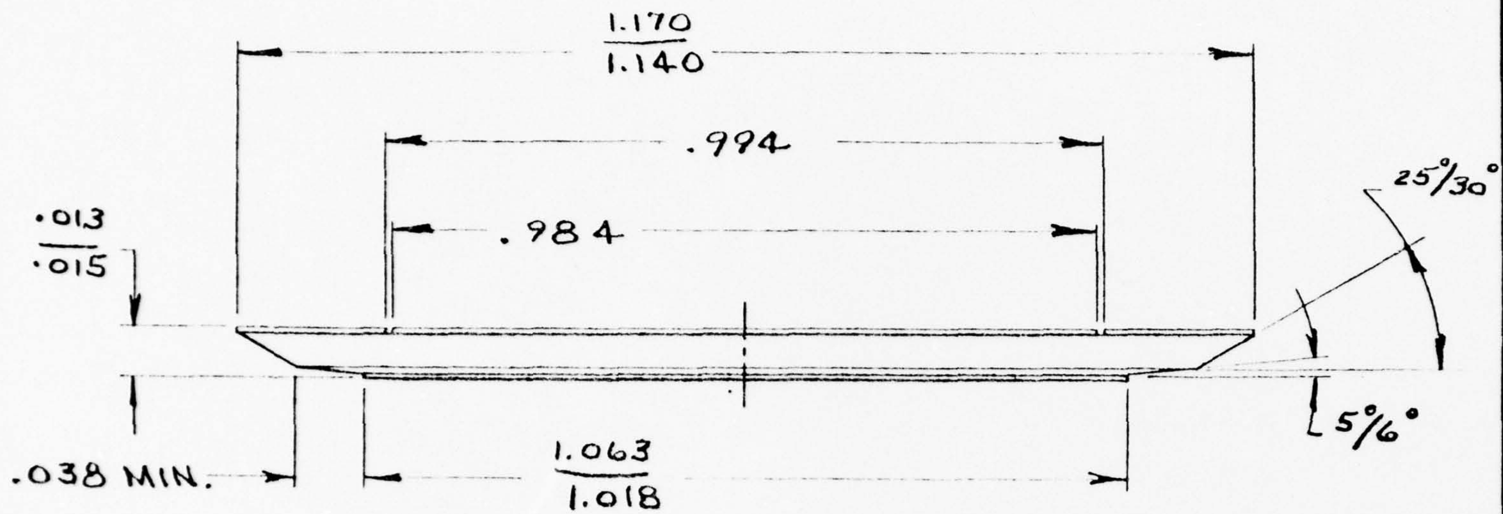
MODEL NO.: J15371C

RCA Electronic Components — EQUIPMENT DEVELOPMENT

DRAWN BY: [illegible] Aug. 27, 1976

SIZE: A

DWG. NO.: 3025279



NOTES:
1. SOLDER DIP WAFER (95/5 LEAD-TIN SOLDER)

CHECKED BY	
APPROVED BY	0

STANDARD TOLERANCE			
BASIC DIM	±	FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED

SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED

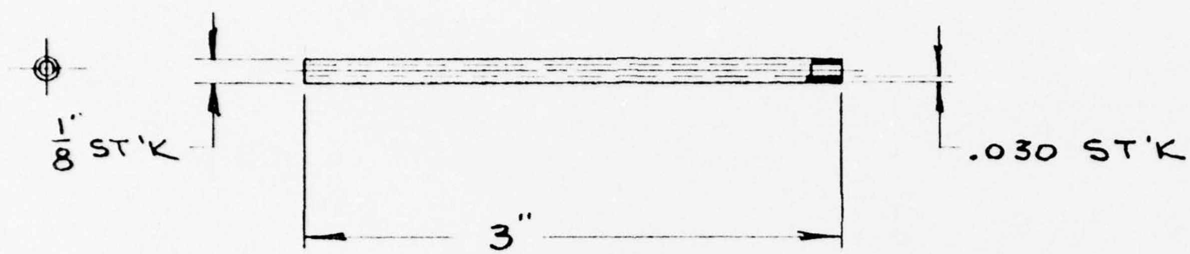
NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

MATERIAL			DWG. TITLE SILICON THYRISTOR WAFER OUTLINE DWG.	
PATTERN NO.	SCALE NONE	USED ON	DESIGN BY	MODEL NO. J15371C
RCA Electronic Components EQUIPMENT DEVELOPMENT			DRAWN BY R. Mihalich Oct. 25, 1976	SIZE A DWG. NO. 3025280

CHECKED BY

APPROVED BY

0



2- REQ'D

STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED

SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART

MATERIAL SOFT COP TUBING (1/8" O.D. x .030 WALL)

PATTERN NO	SCALE	USED ON
	1:1	

RCA Electronic Components EQUIPMENT DEVELOPMENT

DWG. TITLE EXHAUST TUBULATION

DESIGN BY

DRAWN BY R. Miles Sept. 14, 1976

MODEL NO J15371C

SIZE A

DWG NO 3025283

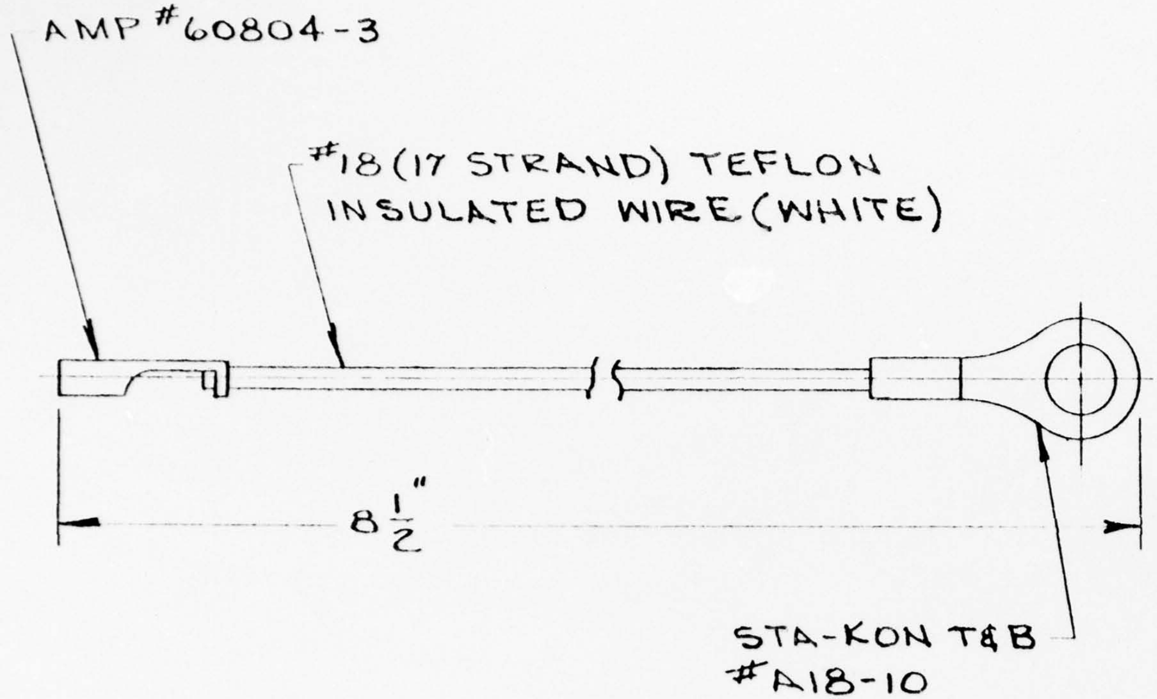
DR. #3 (.213) DIA. x 3/4" ± 1/64" DP.
CONCENTRIC WITH
THREADS

2-REQ'D

MAT'L: 3/8-24 x 1" LG. CUP POINT
SOC. SET SCREW (STN STL)

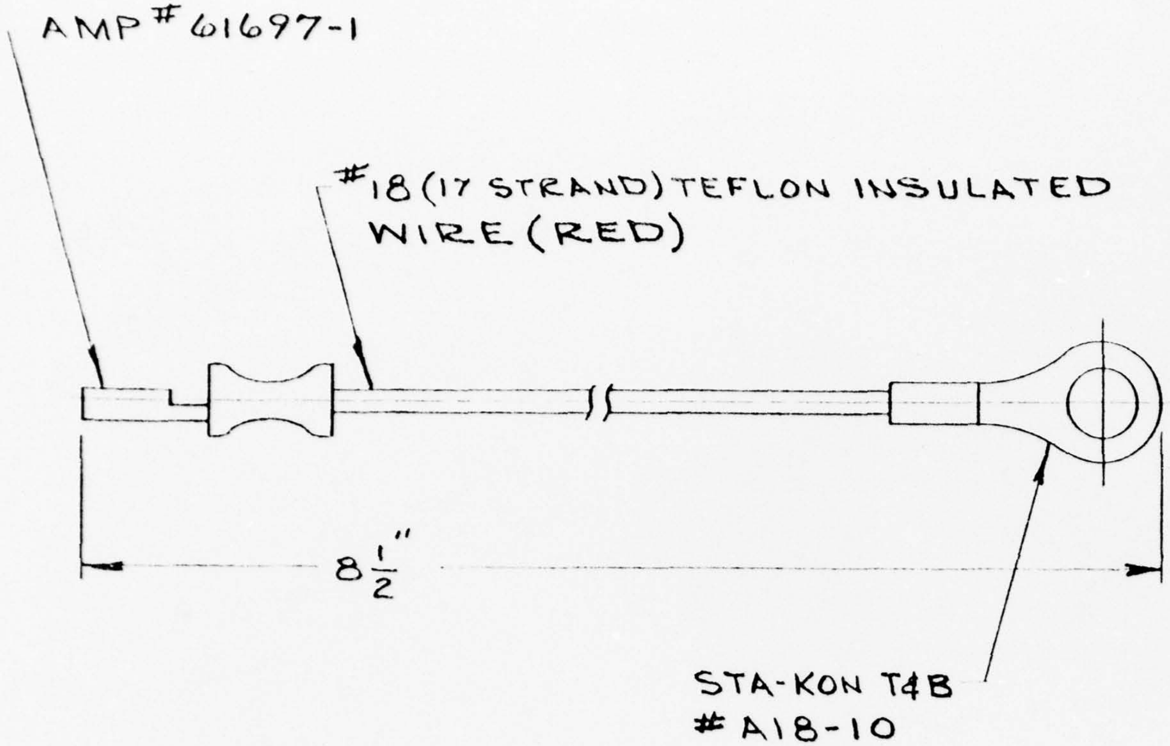
CHECKED BY	
APPROVED BY	0
#3 DR. WAS 7/32"; MAT'L WAS FLAT POINT R. Miles Nov. 1, 1976	1

STANDARD TOLERANCE				NOTES					
BASIC DIM		FRAC	DEC	NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED	MATERIAL: SEE ABOVE			DWG TITLE: STUD	
UP TO 6"	±	1/64	.005	SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED	PATTERN NO.	SCALE 1:1	USED ON	DESIGN BY	MODEL NO. J15371C
ABOVE 6"	±	1/32	.010						
ABOVE 24"	±	1/16	.015	NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART	RCA Electronic Components EQUIPMENT DEVELOPMENT			DRAWN BY R. Miles Sept. 14, 1976	SIZE A DWG. NO. 3025284R1
ANGULAR DIM ± 1/2°									



CHECKED BY				
APPROVED BY				0

STANDARD TOLERANCE										
BASIC DIM		FRAC	DEC	NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED	MATERIAL CHS			DWG TITLE GATE LEAD		
UP TO 6"	±	1/64	.005	SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED	PATTERN NO.	SCALE 2:1	USED ON	DESIGN BY	MODEL NO. J15371C	
ABOVE 6"	±	1/32	.010							
ABOVE 24"	±	1/16	.015	NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART	RCA Electronic Components EQUIPMENT DEVELOPMENT			DRAWN BY R. Niles Sept. 15, 1976	A SIZE	DWG NO. 3025285
ANGULAR DIM ± 1/2°										



CHECKED BY

APPROVED BY

0

STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED

SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART

MATERIAL: H

PATTERN NO.:

SCALE: 2:1

USED ON:

RCA Electronic Components EQUIPMENT DEVELOPMENT

DWG. TITLE: AUXILIARY LEAD

DESIGN BY:

DRAWN BY: R. Miles Sept. 15, 1976

MODEL NO.: J15371 C

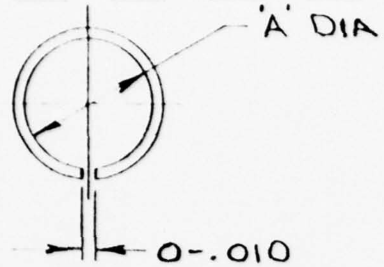
SIZE: A

DWG. NO.: 3025286

CHECKED BY

APPROVED BY

0



PART NO.	'A' DIA.	MATERIAL
A3025552-1	1"	S35W1 .030 DIA.
A3025552-2	5/64"	S35W1 .030 DIA.
A3025552-3	7/8"	C687W1 .020 DIA.
A3025552-4	.835	C687W1 .020 DIA.
A3025552-5	1/8"	S35W1 .030 DIA.

STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED

SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART

MATERIAL: SEE ABOVE

DWG. TITLE: SOLDER RINGS

PATTERN NO.:

SCALE: NONE

USED ON:

DESIGN BY:

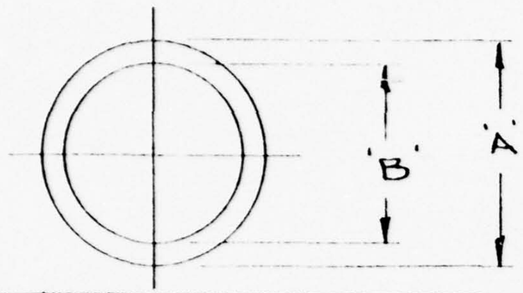
MODEL NO.: J15371C

RCA Electronic Components EQUIPMENT DEVELOPMENT

DRAWN BY: R. Niles Sept. 21, 1972

SIZE: A

DWG. NO.: 3025552



PART NO.	'A'	'B'	MATERIAL
3025555-1	1.080	.880	S636S x .003 TH'K
3025555-2	1.500	1.315	S35S x .003 TH'K
3025555-3	.150	.063	C687S1 x .004 TH'K

CHECKED BY

APPROVED BY

0

STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A; INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.

SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

MATERIAL: SEE ABOVE

PATTERN NO:

SCALE: NONE

USED ON:

RCA Electronic Components — EQUIPMENT DEVELOPMENT

DWG. TITLE: SOLDER WASHER

DESIGN BY:

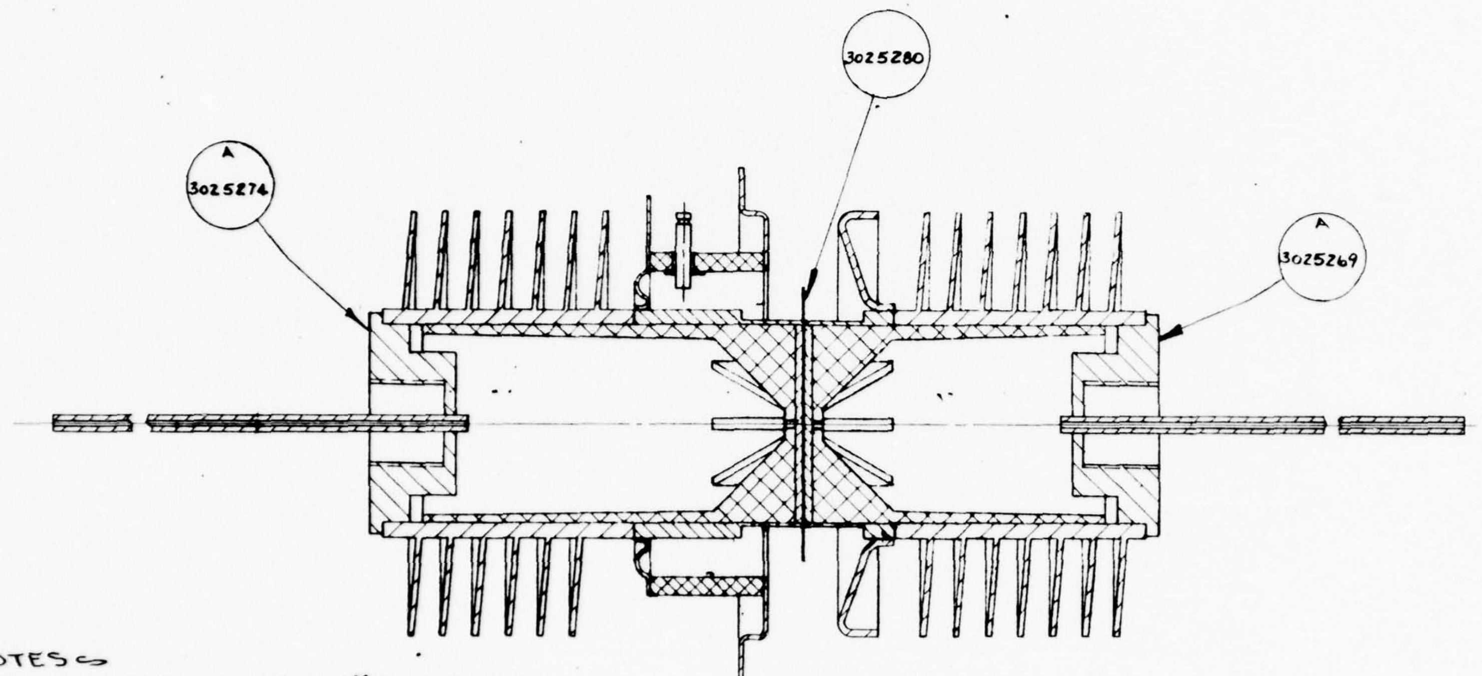
MODEL NO: J15371C

DRAWN BY: E. Niles Oct. 5, 1976

SIZE: A

DWG NO: 3025555

REVISIONS	
CHECKED BY	
APPROVED BY	O



NOTES:
1. USE BRAZING FIXT. #3025289

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STANDARD TOLERANCE				NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED	MATERIAL			DWG TITLE THYRISTOR ASS'Y, BRAZED	
BASIC DIM		FRAC	DEC						
UP TO 6"	±	1/64	.005	SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED	PATTERN NO.	SCALE 2:1	USED ON	DESIGN BY	MODEL NO. J15371C
ABOVE 6"	±	1/32	.010						
ABOVE 24"	±	1/16	.015	NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART	RADIO CORPORATION OF AMERICA EQUIPMENT DEVELOPMENT			DRAWN BY R. Miles Oct. 25, 1976	SIZE B DWG NO. 3025569
ANGULAR DIM	±	1/2°							

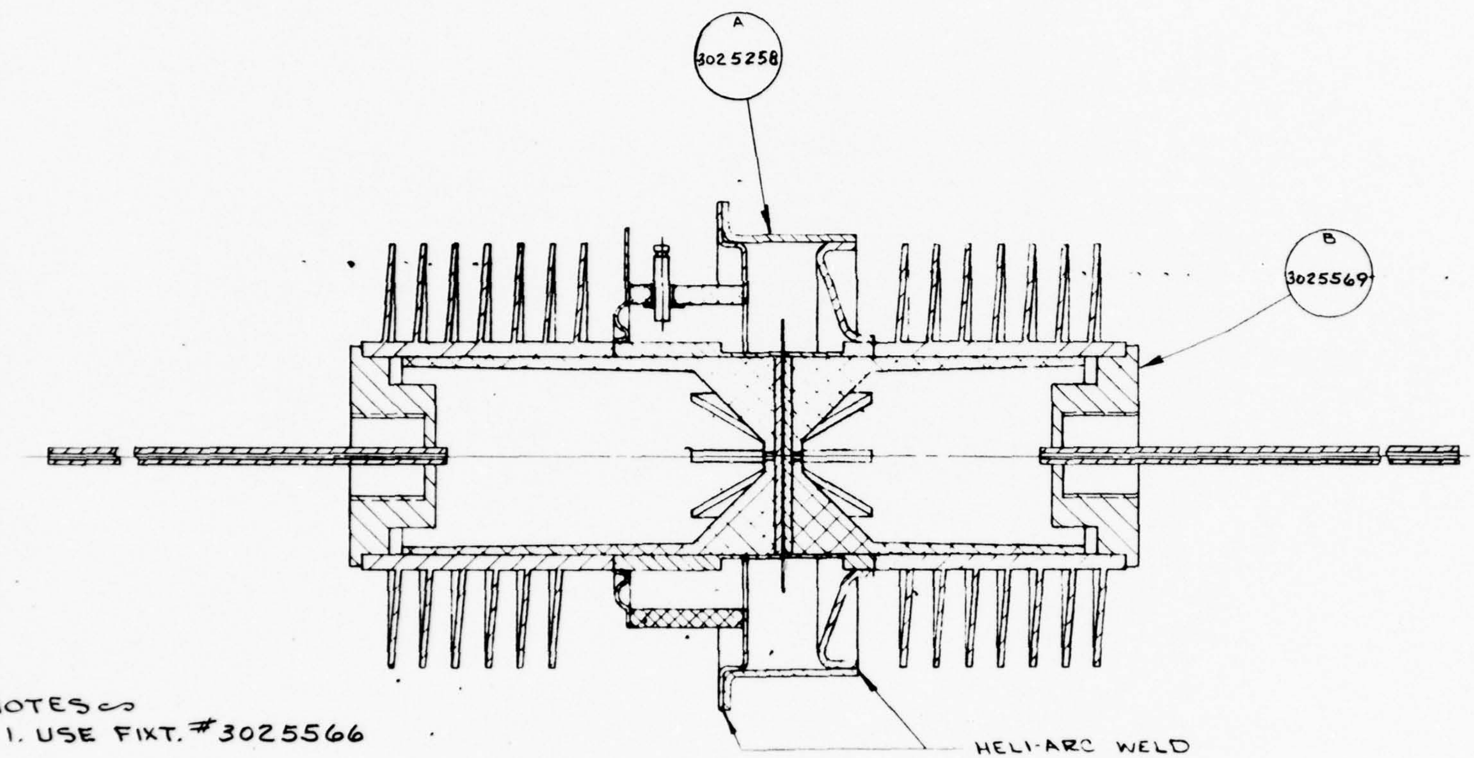
DEFIANCE 4D 1020F-B 470

REVISIONS

CHECKED BY

APPROVED BY

0



NOTES:
1. USE FIXT. #3025566

STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC.
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM.	±	1/2°	

NOTE: THREADS EXTERNAL, CLASS 2A INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED

SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

MATERIAL: CH

PATTERN NO.

SCALE: 2:1

USED ON

RADIO CORPORATION OF AMERICA
EQUIPMENT DEVELOPMENT

DWG TITLE: THYRISTOR ASS'Y, WELDED

DESIGN BY

MODEL NO. J15371C

DRAWN BY: R. Miles Oct. 25, 1976

SIZE: B

DWG NO. 3025570

T 660 12/56

DEFIANCE NO. 1020F-8 470

APPENDIX B

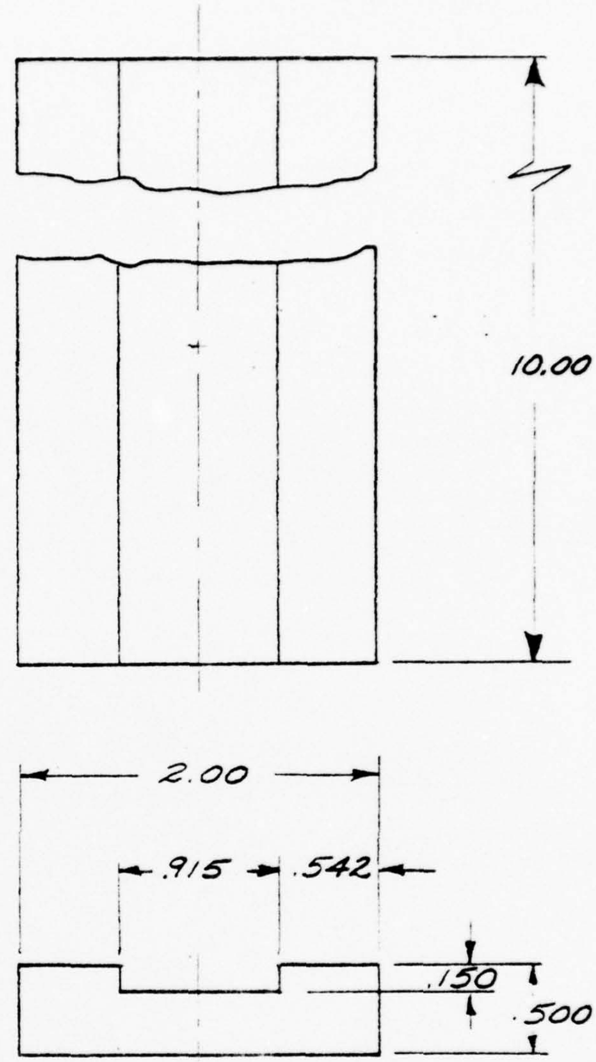
Tooling and Photo-Mask Drawings

(Note: Organized in numerical order by Drawing Number.)

REVISIONS	
BY	0
DATE	

DIMENSIONS ARE IN INCHES AND INCLUDE THICKNESS OF PLATING. DO NOT SCALE DRAWING. ALL EXTERNAL THREADS TO BE CLASS 2A BEFORE PLATING AND NOT GREATER THAN THE MAXIMUM SIZE OF CLASS 3A AFTER PLATING. ALL INTERNAL THREADS TO BE CLASS 2B UNLESS OTHERWISE SPECIFIED. ALL THREADS TO BE UNIFIED STANDARD SCREW THREAD SERIES UNLESS OTHERWISE SPECIFIED.

3025232



MATERIAL – 304 STN. ST'L

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TOLERANCES AND WORKMANSHIP REQUIREMENTS NOT SPECIFIED ON THIS DRAWING SHALL CONFORM TO SPECIFICATION 93650.

BASIC DIMENSIONS	2 PLACE DECIMALS		3 PLACE DECIMALS
UP THRU 6			
6 THRU 24			
ABOVE 24			
ANGULAR DIMENSIONS			

RCA — RCA CORPORATION

BRAZING BASE

FIRST MADE FOR — USED ON

DRAWN BY R G HERR 5-7-75

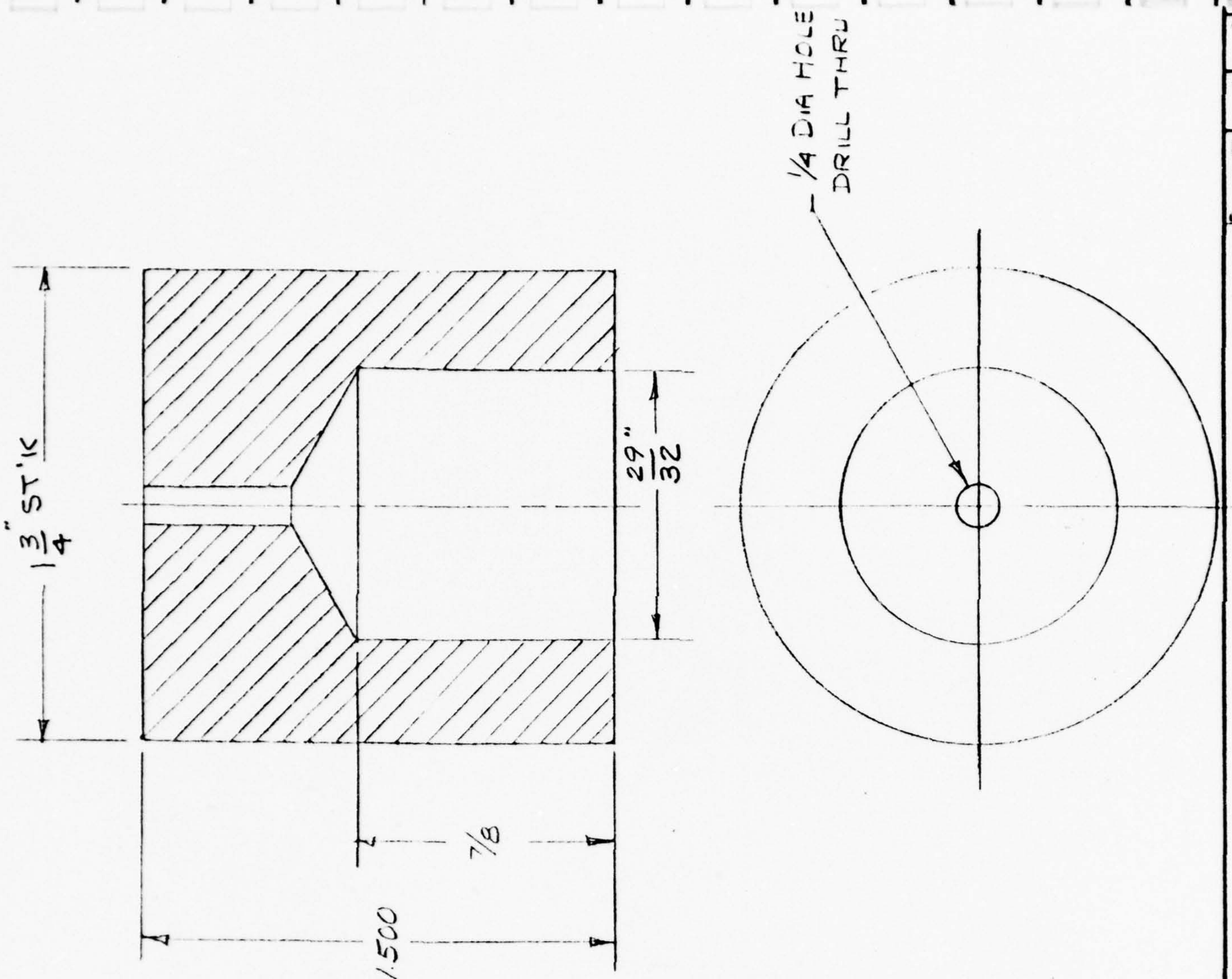
DESIGNED BY S.W. KESSLER

CHECKED BY

COMMODITY CODE

A SIZE — 3025232

CODE IDENT NO. 49671 — SHEET — CONT'D ON SH

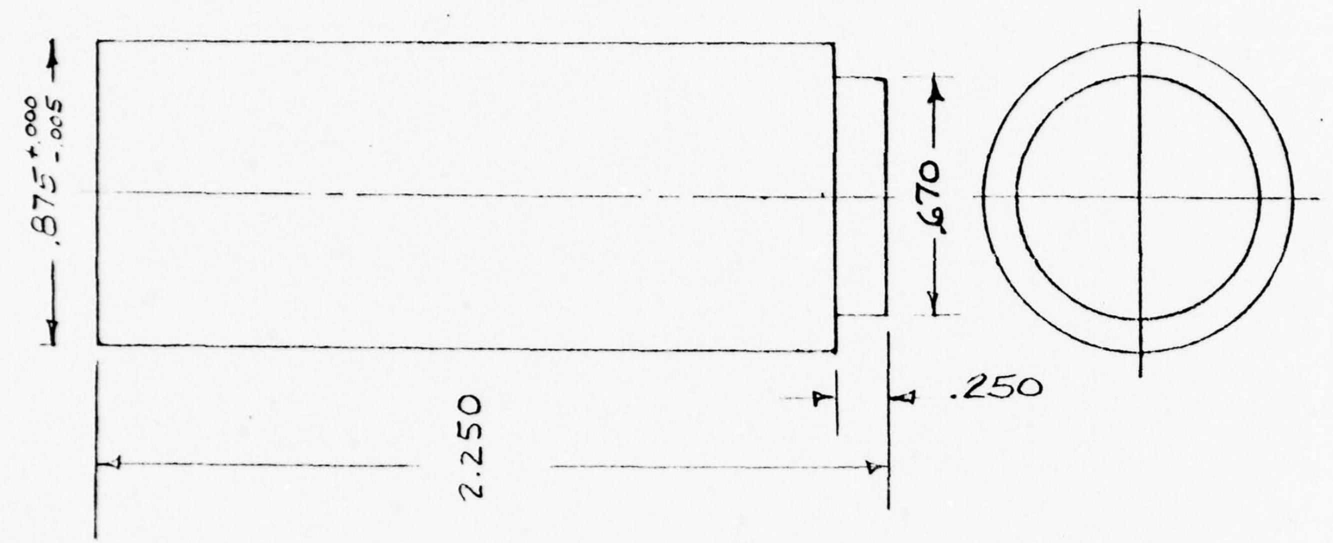


CHECKED BY			
APPROVED BY			0
1 3/4 ST'K WAS 1.500; 29/32 WAS 15/16			
W. Miller Sept. 12, 1976			1

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF RCA CORPORATION AND ARE NOT TO BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR THE MANUFACTURE OR SALE OF APPARATUS AND OR DEVICES WITHOUT PERMISSION

STANDARD TOLERANCE				NOTE		
BASIC DIM		FRAC	DEC	NOTE: THREADS EXTERNAL, CLASS 2A; INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.		
UP TO 6"	±	1/64	.005	SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED		
ABOVE 6"	±	1/32	.010			
ABOVE 24"	±	1/16	.015	NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART		
ANGULAR DIM ± 1/2°						

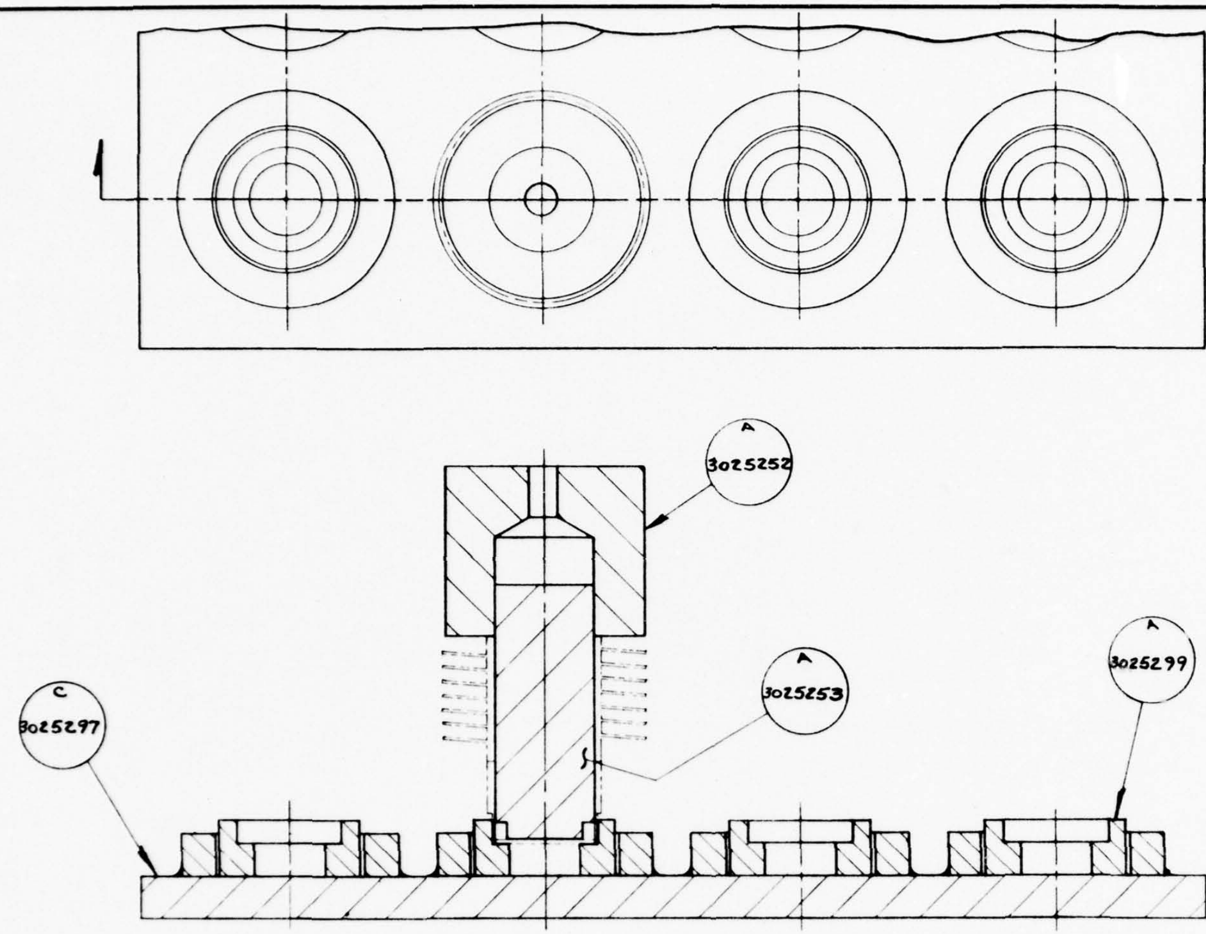
MATERIAL: 304 STN STL			DWG. TITLE: HEAT PIPE SUB ASS'Y BRAZING WEIGHT	
PATTERN NO.	SCALE	USED ON	DESIGN BY	MODEL NO.
RCA Electronic Components EQUIPMENT DEVELOPMENT			DRAWN BY: W. J. Burkins	SIZE A — DWG. NO. 302 5252R1



NOTES:
1. COAT WITH BLACK EMISSIVITY COATING PER SCHED. B-1

CHECKED BY			
APPROVED BY			0

STANDARD TOLERANCE						
BASIC DIM		FRAC	DEC	NOTE: THREADS EXTERNAL, CLASS 2A; INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED	MATERIAL 304 STN STL	DWG. TITLE FINNED TUBING BRAZING FIXTURE
UP TO 6"	±	1/64	.005	SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED	PATTERN NO. / SCALE / USED ON	DESIGN BY W. J. Burkins — MODEL NO
ABOVE 6"	±	1/32	.010			
ABOVE 24"	±	1/16	.015	NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART	RCA Electronic Components EQUIPMENT DEVELOPMENT	DRAWN BY W. J. Burkins — SIZE A — DWG. NO 302 5253
ANGULAR DIM ± 1/2°						



REVISIONS

CHECKED BY

APPROVED BY

0

~ USE FOR ASS'Y #3025242 &
#3025272 ~

STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM.	±	1/2°	

NOTE: THREADS EXTERNAL, CLASS 2A; INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.

SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED.

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

MATERIAL: CH

PATTERN NO.

SCALE: 1:1

USED ON

RADIO CORPORATION OF AMERICA
~~EQUIPMENT DEVELOPMENT~~

DWG. TITLE: ANODE & CATH. BODY SUB-ASS'Y BRAZING FIXT.

DESIGN BY

MODEL NO.: J15371C

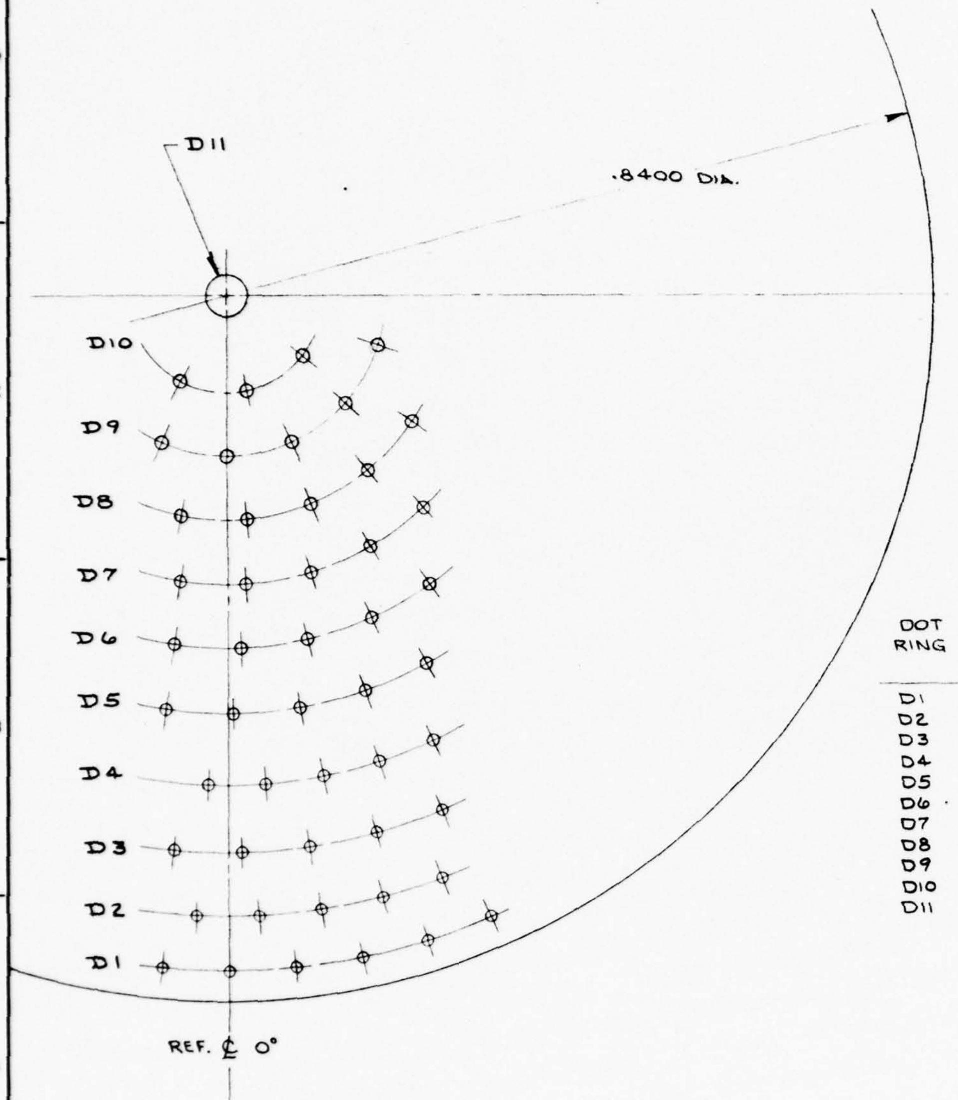
DRAWN BY: R. Miles Sept. 20, 1976

SIZE: B

DWG. NO.: 3025254

T 660 12/56

DEFIANCE NO. 1020F-B 470



NOTES:
1. THIS PATTERN IS SUPERIMPOSED ON THE EMITTER & BASE DIFFUSION MASKS NO.S 3025262 & 3025263

DOT RING	DIA. OF RING	CHORD PER DOT	DOTS PER RING	ANGLE FROM REF. ℄ 0° TO FIRST DOT
D1	.8021	.0400	63	0.0000°
D2	.7380	.0368	63	2.8571°
D3	.6621	.0400	52	1.4286°
D4	.5820	.0351	52	4.2857°
D5	.4966	.0400	39	0.7143°
D6	.4202	.0399	33	2.1429°
D7	.3438	.0399	27	3.5714°
D8	.2674	.0399	21	5.0000°
D9	.1910	.0397	15	0.0000°
D10	.1146	.0392	9	12.0000°
D11	.0250	——	1	——

REVISIONS: CHECKED BY / APPROVED BY / 0 / REDRAWN / 1

STANDARD TOLERANCE — NOTE: THREADS EXTERNAL CLASS 2A, INTERNAL CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED. SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED. NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

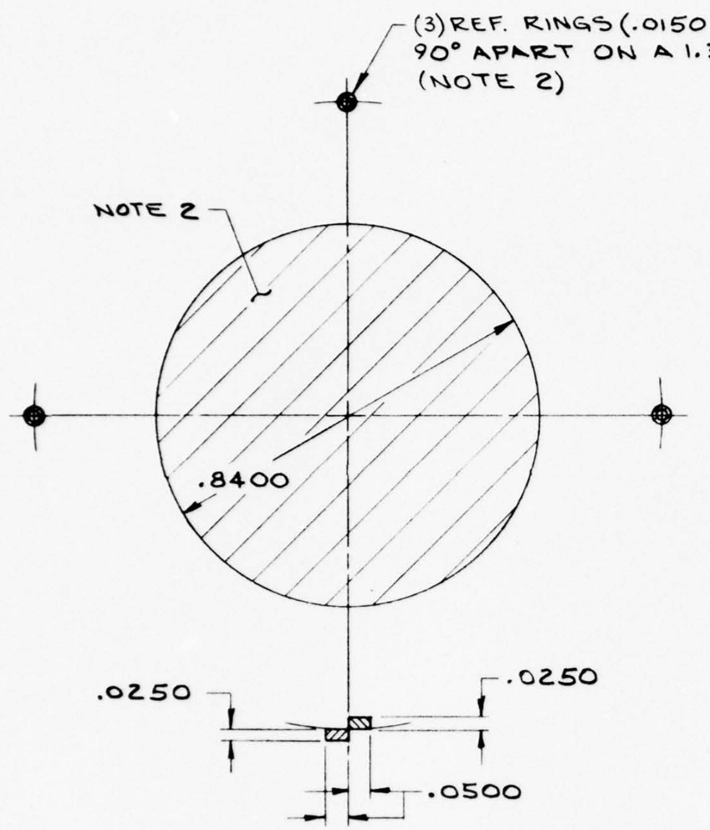
MATERIAL | PATTERN NO | SCALE 20:1 | USED ON

RCA Electronic Components — EQUIPMENT DEVELOPMENT

DWG TITLE: SHORTING DOT PATTERN
DESIGN BY
MODEL NO: J1537IC
DRAWN BY: S.W. KESSLER 8/5/76
SIZE C — DWG NO: 3025261R1

BRUNING 40-22 19782

REVISIONS	
CHECKED BY	
APPROVED BY	0



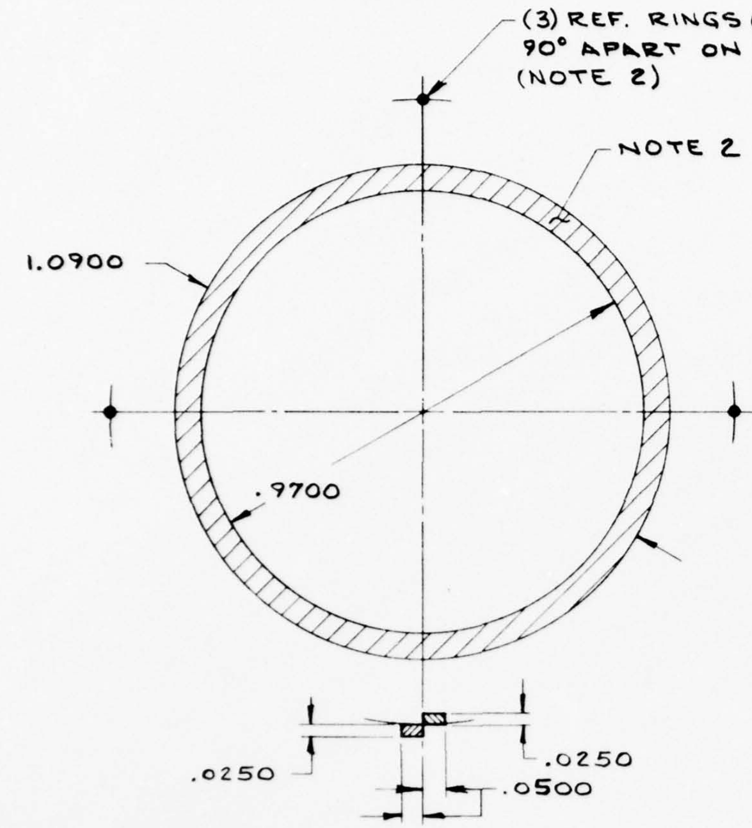
NOTES:

1. SEE DWG. NO. 3025261 FOR SHORTING DOT PATTERN
2. CROSS-HATCHED AREA IS CHROME ON MASK (NEG. RESIST)
3. TOL. ON MASK ±.0002 FOR ALL DIM.'S
4. PRINT MASK ON 2½ x 2½ SLIDES
5. THIS MASK IS REFERRED TO AS MASK 'A' ON PROCESS SHEETS

STANDARD TOLERANCE				NOTE: THREADS EXTERNAL, CLASS 2A; INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.	MATERIAL			DWG. TITLE	
BASIC DIM.		FRAC	DEC.					MASK FOR N+ EMITTER DIFFUSION	
UP TO 6"	±	1/64	.005	SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED.	PATTERN NO.	SCALE 4:1	USED ON	DESIGN BY	MODEL NO. J15371C
ABOVE 6"	±	1/32	.010						
ABOVE 24"	±	1/16	.015	NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.	RADIO CORPORATION OF AMERICA ~~EQUIPMENT DEVELOPMENT~~			DRAWN BY R. Nuber Dec. 1, 1976	B SIZE DWG. NO. 3025262
ANGULAR DIM.	±	1/2°							

T 960 12/56

DEFIANCE NO. 1020F-8 470



NOTES

1. SEE DWG. NO. 3025261 FOR SHORTING DOT PATTERN
2. CROSS-HATCHED AREA IS CHROME ON MASK (NEG. RESIST)
3. TOL. ON MASK ±.0002 FOR ALL DIM'S
4. PRINT MASK ON 2½ x 2½ SLIDES
5. THIS MASK IS REFERRED TO AS MASK 'B' ON PROCESS SHEETS

REVISIONS	
CHECKED BY	
APPROVED BY	0
REDRAWN; ADDED NOTE 5 R. Miles Nov. 30, 1976	1

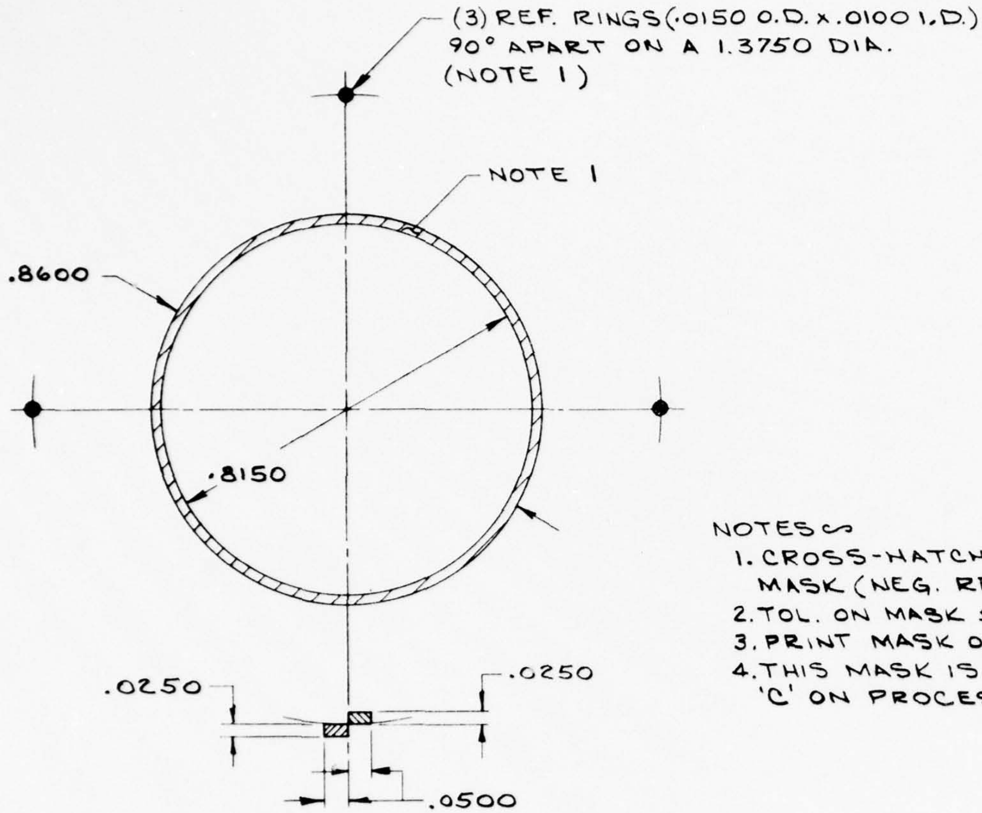
STANDARD TOLERANCE					
BASIC DIM.		FRAC.	DEC.	NOTE: THREADS EXTERNAL, CLASS 2A; INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.
UP TO 6"	±	1/64	.005	SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED.
ABOVE 6"	±	1/32	.010	
ABOVE 24"	±	1/16	.015	NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.
ANGULAR DIM.	±	1/2°		

MATERIAL: H		
PATTERN NO.	SCALE: 4:1	USED ON
RADIO CORPORATION OF AMERICA	~~EQUIPMENT DEVELOPMENT~~	

DWG. TITLE: MASK FOR P^+ GATE DIFFUSION	
DESIGN BY: S.W. KESSLER 8/5/76	MODEL NO. J1537C
DRAWN BY: S.W. KESSLER 8/5/76	SIZE: B — DWG. NO. 3025263R1

T 660 12/56

DEFIANCE NO. 1080F-8 470



NOTES:

1. CROSS-HATCHED AREA IS CHROME ON MASK (NEG. RESIST)
2. TOL. ON MASK ±.0002 FOR ALL DIM.'S
3. PRINT MASK ON 2 1/2 x 2 1/2 SLIDES
4. THIS MASK IS REFERRED TO AS MASK 'C' ON PROCESS SHEETS

REVISIONS	
CHECKED BY	
APPROVED BY	0
REDRAWN; ADDED NOTE 4 R. Miles Nov. 30, 1976	1

STANDARD TOLERANCE			
BASIC DIM.		FRAC.	DEC.
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM.	± 1/2°		

NOTE: THREADS EXTERNAL, CLASS 2A; INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.

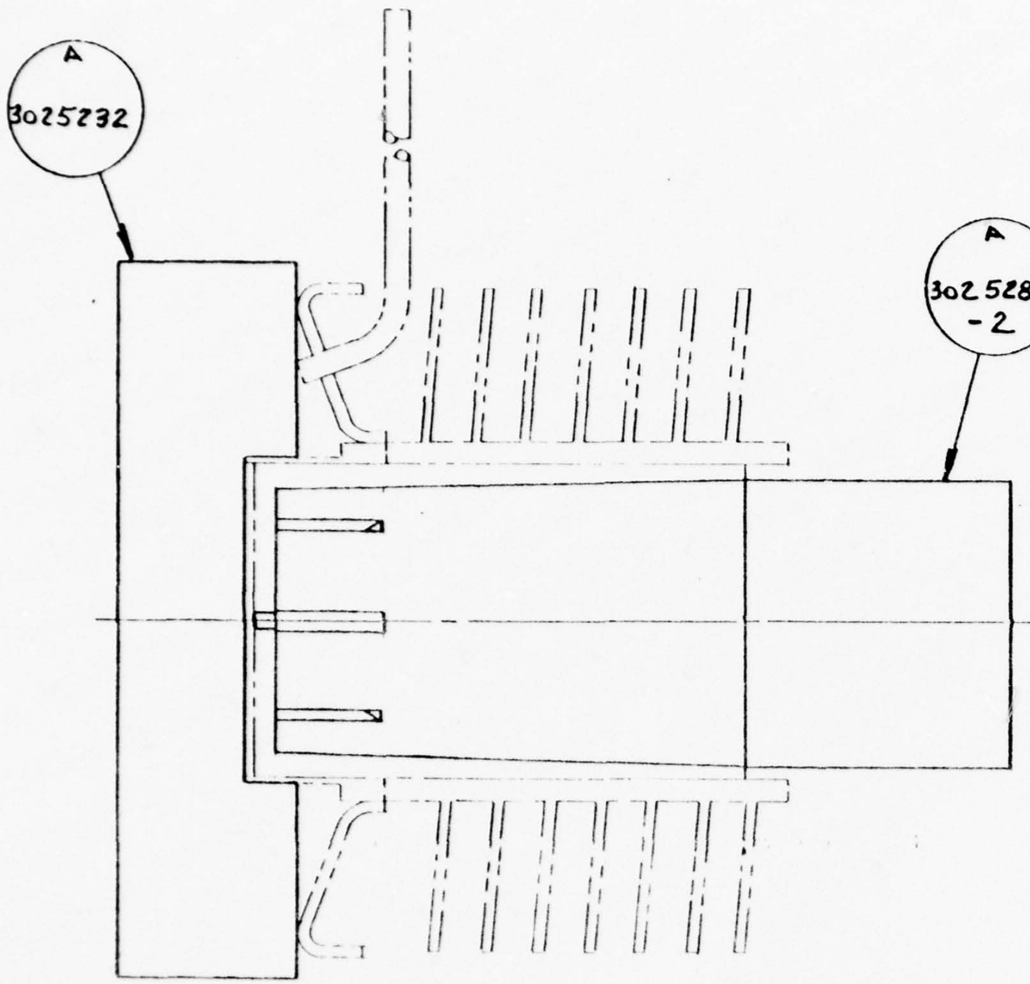
SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED.

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

MATERIAL			DWG. TITLE	
CH			TRIGGER FINGER ETCH MASK	
PATTERN NO.	SCALE 4:1	USED ON	DESIGN BY	MODEL NO. J15371C
RADIO CORPORATION OF AMERICA ~~EQUIPMENT DEVELOPMENT~~			DRAWN BY S.W. KESSLER 8/5/76	SIZE B DWG. NO. 3025264R1

T 660 12/56

DEFIANCE NO. 1080F-8 470



USE FOR ASS'Y #3025271

CHECKED BY			
APPROVED BY			0

STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A; INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.

SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART

MATERIAL: H

PATTERN NO.

SCALE: 2:1

USED ON

RCA Electronic Components — EQUIPMENT DEVELOPMENT

DWG. TITLE: ANODE BODY BRAZING FIXT.

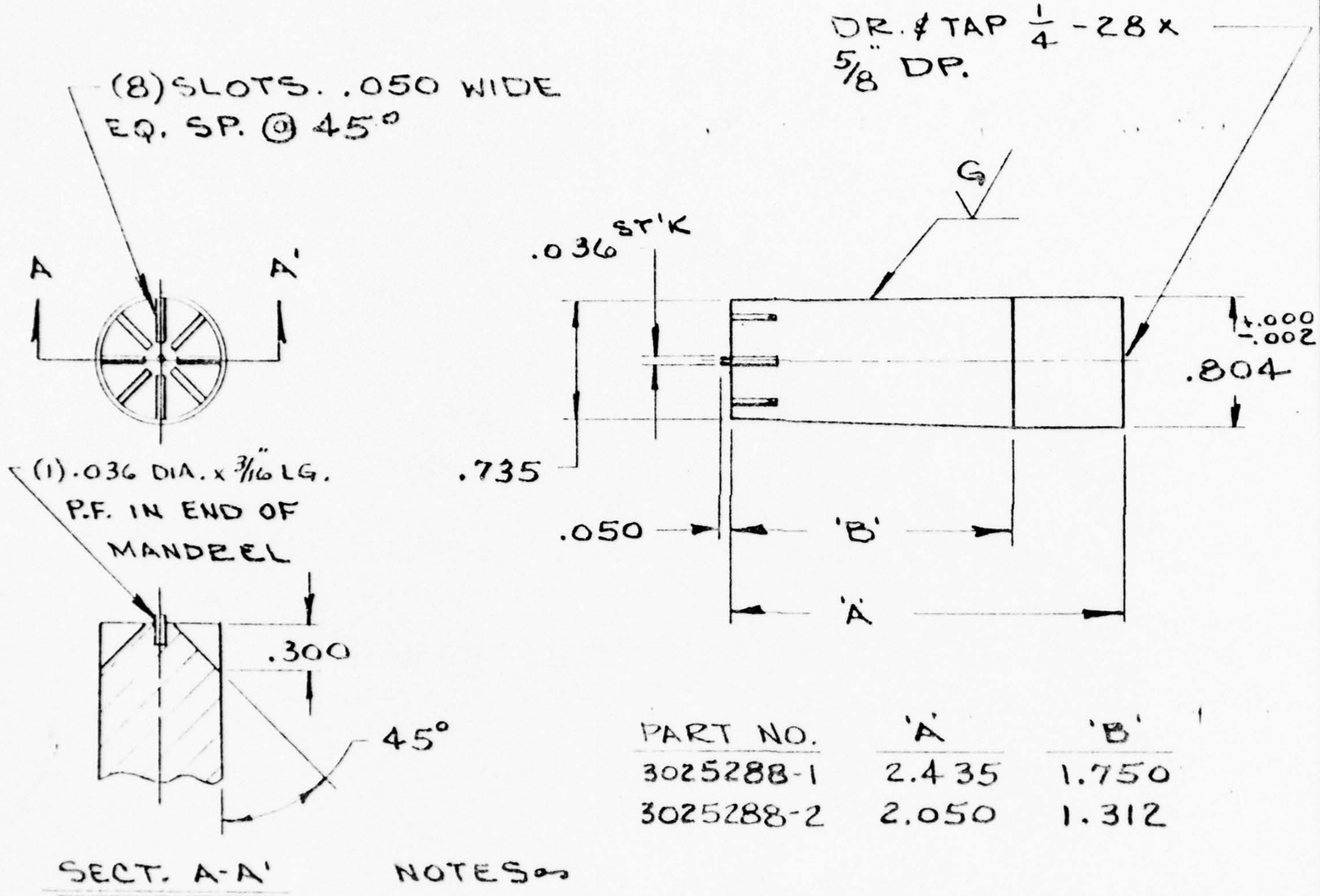
DESIGN BY

DRAWN BY: R. Miles Sept. 8, 1976

MODEL NO.: J15371C

SIZE: A

DWG. NO.: 3025287



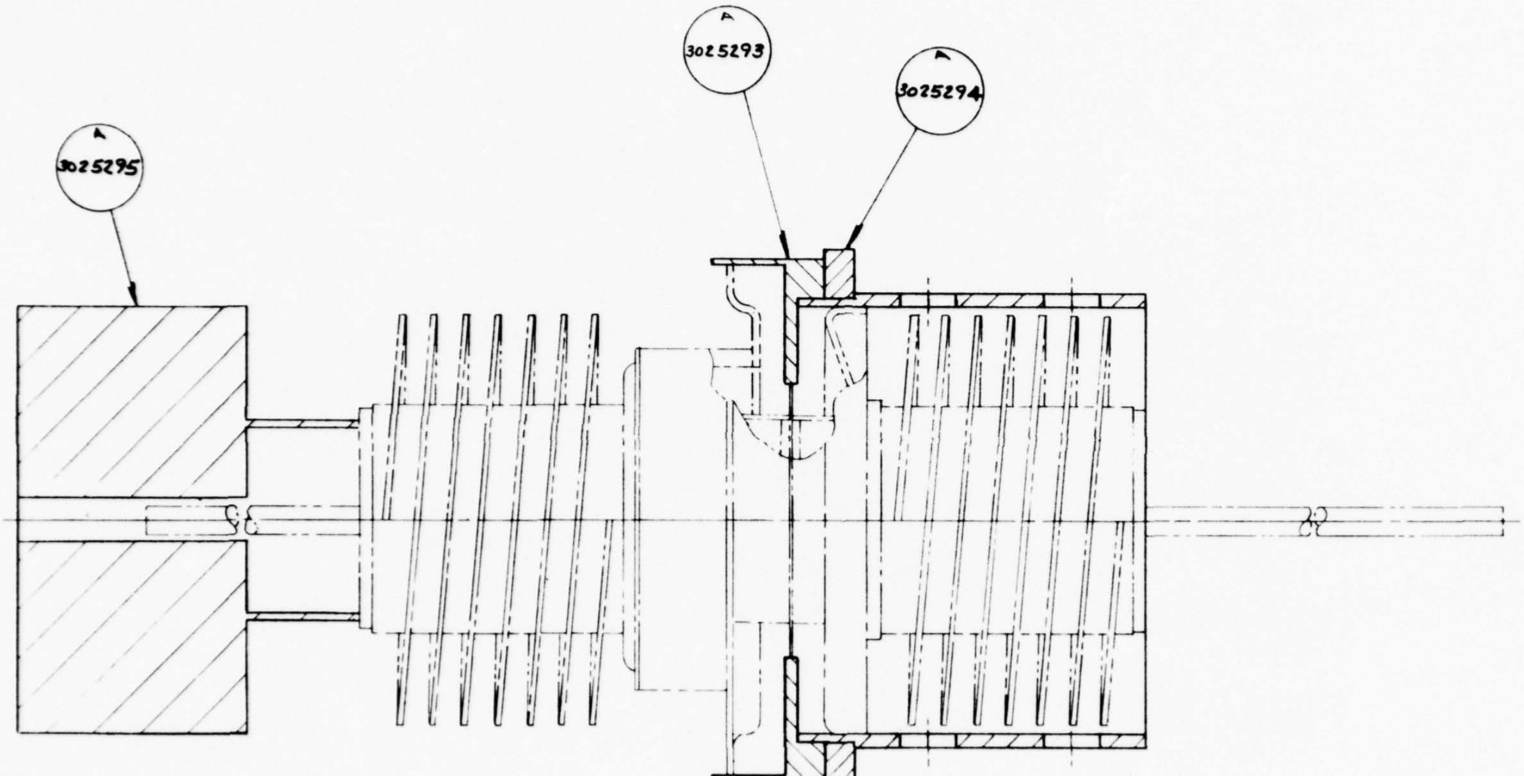
PART NO.	'A'	'B'
3025288-1	2.435	1.750
3025288-2	2.050	1.312

NOTES:

1. COAT WITH BLACK EMISSIVITY COATING PER SCHED. B-1

CHECKED BY	
APPROVED BY	0

STANDARD TOLERANCE				NOTE					
BASIC DIM		FRAC	DEC	NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED	MATERIAL 304 STN STL			DWG. TITLE WICKING MANDREL	
UP TO 6"	±	1/64	.005	SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED	PATTERN NO	SCALE 1:1	USED ON	DESIGN BY	MODEL NO J15371C
ABOVE 6"	±	1/32	.010						
ABOVE 24"	±	1/16	.015	NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART	RCA Electronic Components EQUIPMENT DEVELOPMENT			DRAWN BY R. Miles Sept. 10, 1976	SIZE A DWG. NO. 3025288
ANGULAR DIM ± 1/2°									



REVISIONS	
CHECKED BY	
APPROVED BY	O

STANDARD TOLERANCE				NOTE	
BASIC DIM		FRAC	DEC	NOTE: THREADS EXTERNAL, CLASS 2A. INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.	
UP TO 6"	±	1/64	.005	SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED.	
ABOVE 6"	±	1/32	.010		
ABOVE 24"	±	1/16	.015	NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.	
ANGULAR DIM.	±	1/2°			

MATERIAL: CHS

PATTERN NO. | SCALE: 2:1 | USED ON

RADIO CORPORATION OF AMERICA
~~EQUIPMENT DEVELOPMENT~~

DWG. TITLE: THYRISTOR ASS'Y BRAZING FIXT.

DESIGN BY

MODEL NO. J15371C

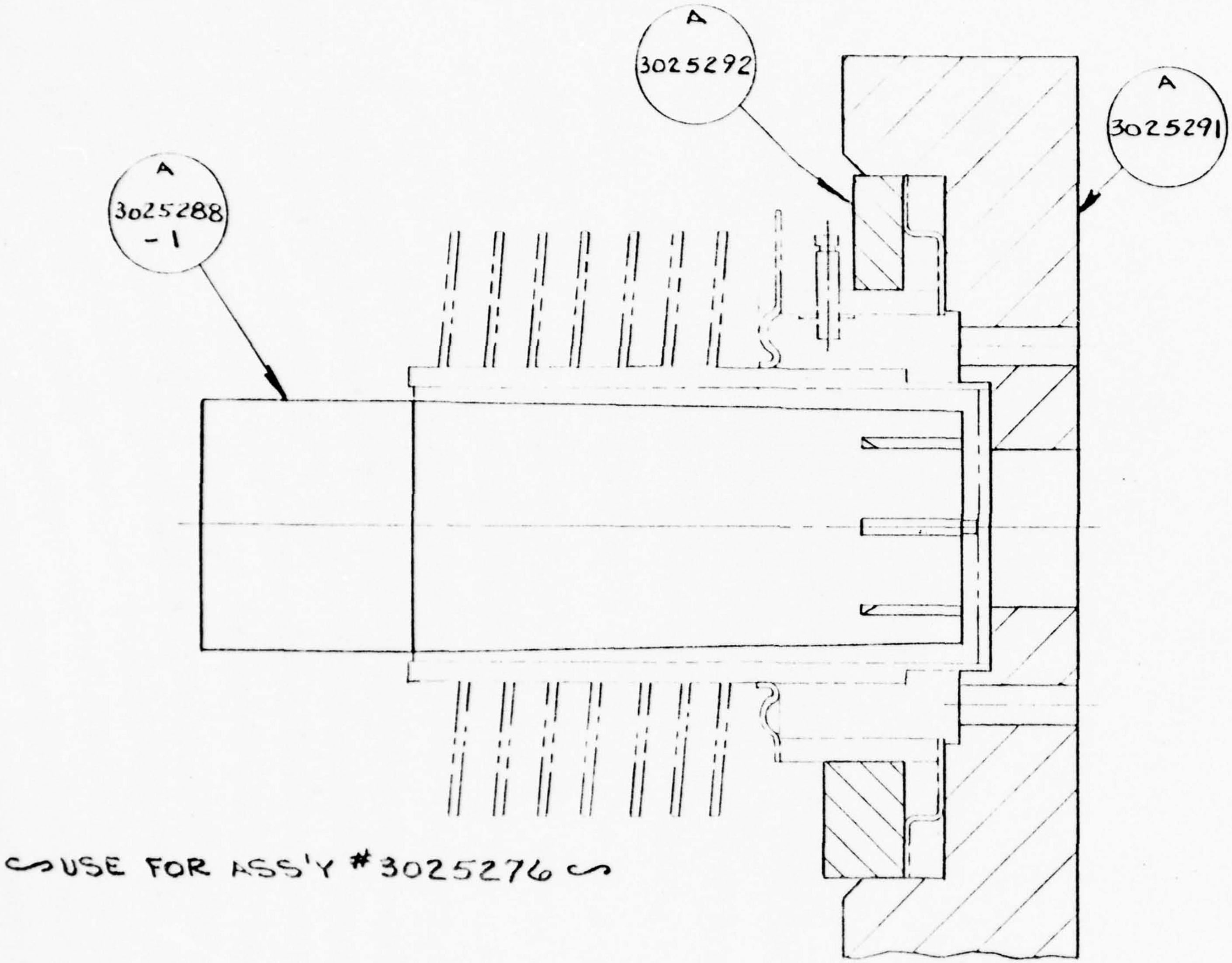
DRAWN BY: R. Miles Oct. 20, 1976

SIZE: B

DWG. NO. 3025289

T 660 12/56

DEFIANCE NO. 1020F-8 470



CHECKED BY

APPROVED BY

0

STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED

SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART

MATERIAL: CH

PATTERN NO.

SCALE: 2:1

USED ON

RCA Electronic Components EQUIPMENT DEVELOPMENT

DWG TITLE: CATHODE BODY BRAZING FIXT.

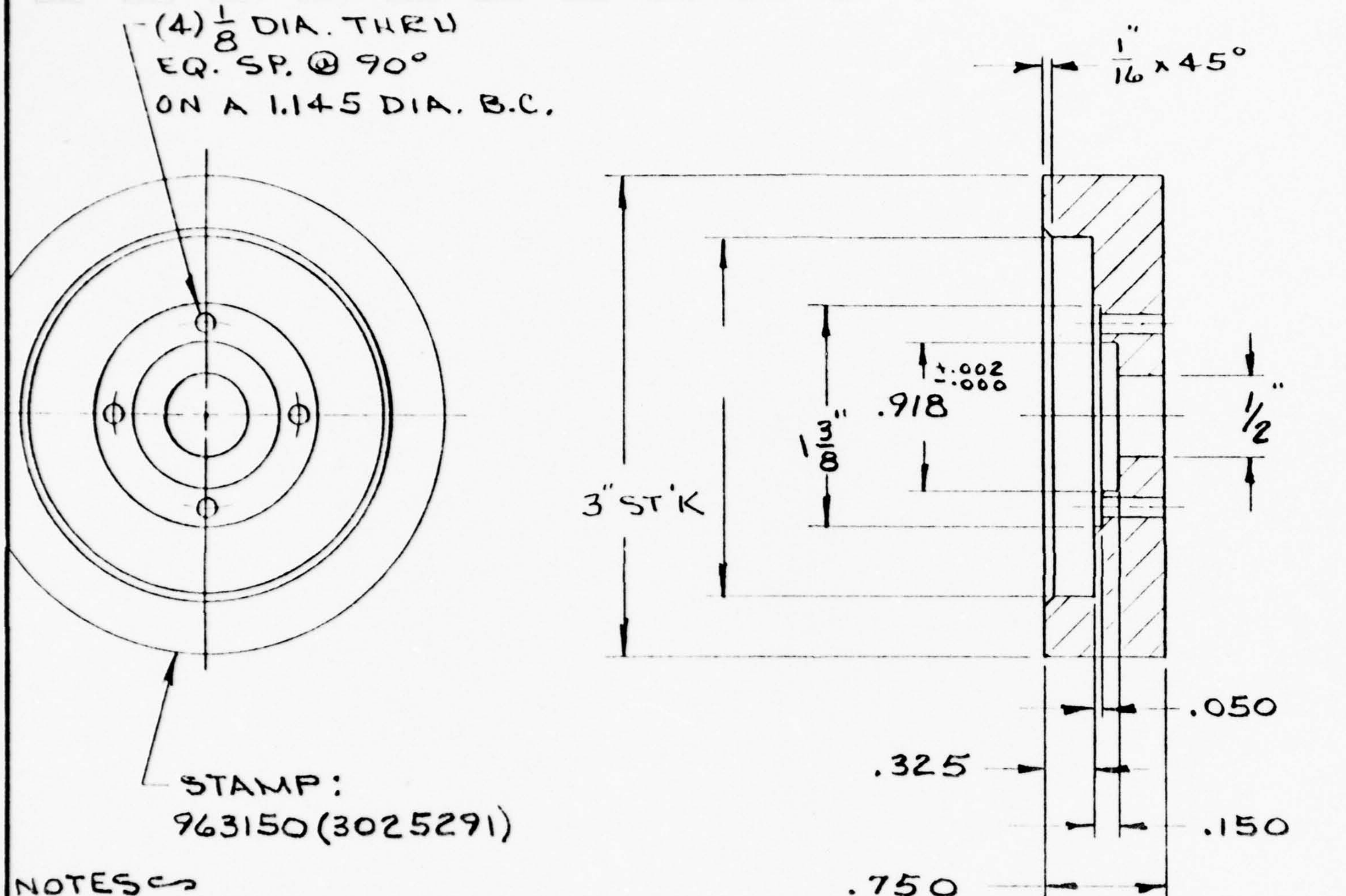
DESIGN BY

MODEL NO: J15371C

DRAWN BY: R. Miles Sept. 9, 1976

SIZE: A

DWG NO: 3025290



NOTES:
1. COAT WITH BLACK EMISSIVITY COATING PER SCHED. B-1

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STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE. THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED

SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED

NOTE. SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART

MATERIAL: 304 STN STL

DWG. TITLE: BASE

PATTERN NO: | SCALE: 1:1 | USED ON:

DESIGN BY:

MODEL NO: J15371C

RCA Electronic Components — EQUIPMENT DEVELOPMENT

DRAWN BY: R. Niles Sept. 9, 1976

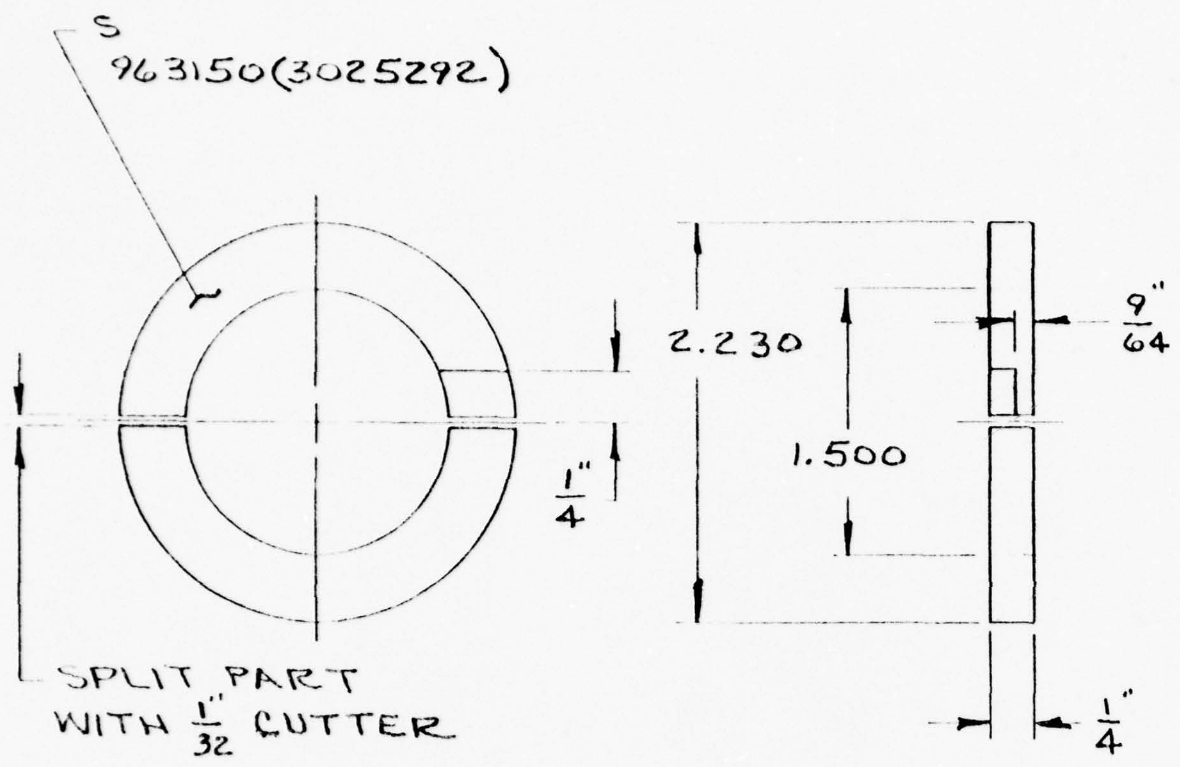
SIZE: A

DWG. NO: 3025291

CHECKED BY:

APPROVED BY:

0



NOTES:

1. COAT WITH BLACK EMISSIVITY COATING PER SCHED. B1

CHECKED BY

APPROVED BY | 0

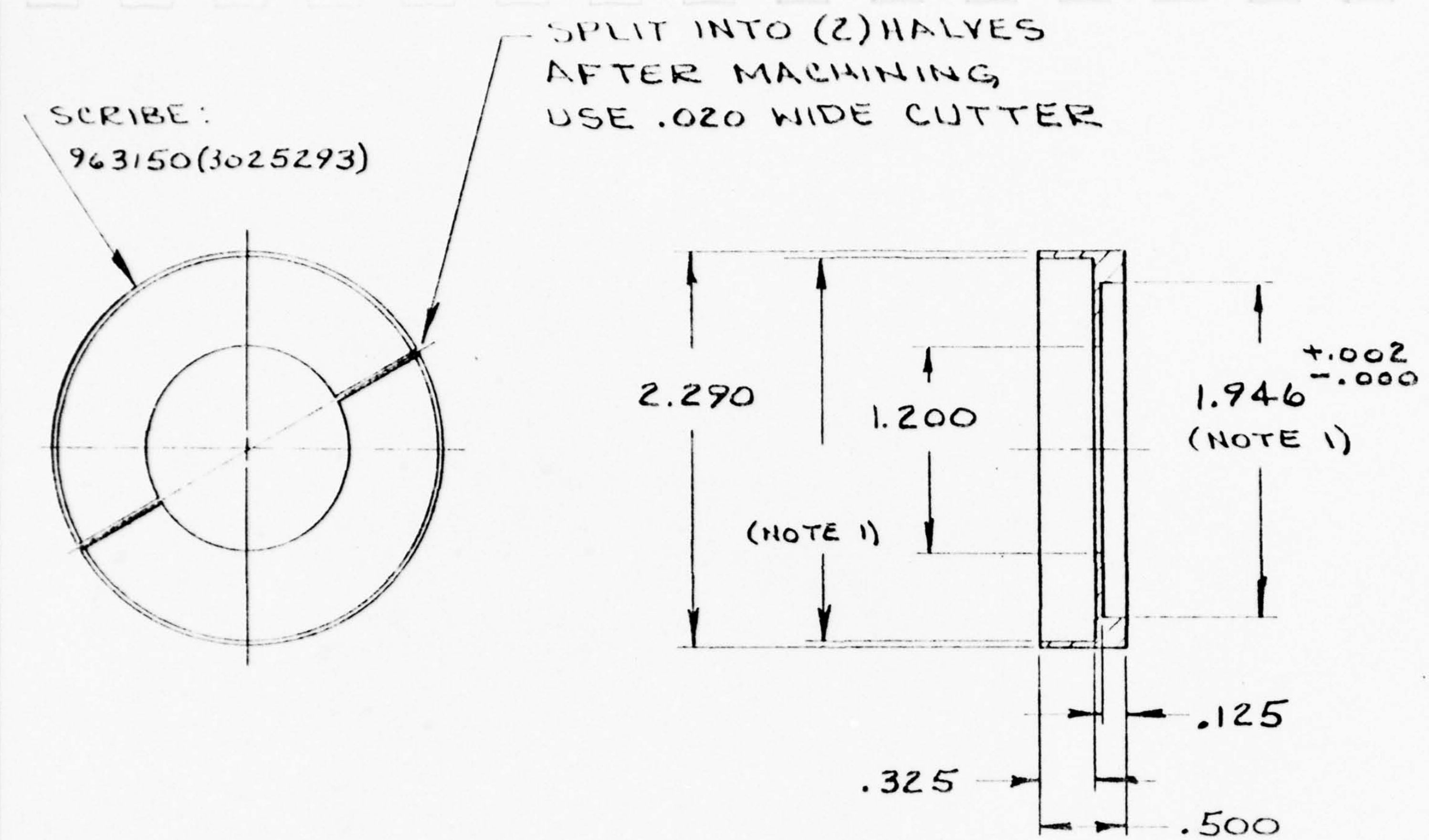
STANDARD TOLERANCE						
BASIC DIM		FRAC	DEC	NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED	MATERIAL 304 STN STL	DWG TITLE CENTERING RING
UP TO 6"	±	1/64	.005	SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED	PATTERN NO. / SCALE 1:1 / USED ON	DESIGN BY / MODEL NO. J15371C
ABOVE 6"	±	1/32	.010			
ABOVE 24"	±	1/16	.015	NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART	RCA Electronic Components EQUIPMENT DEVELOPMENT	DRAWN BY R. Mello Sept. 9, 1976 / SIZE A / DWG NO. 3025292
ANGULAR DIM ± 1/2°						

[redacted]

CHECKED BY

APPROVED BY

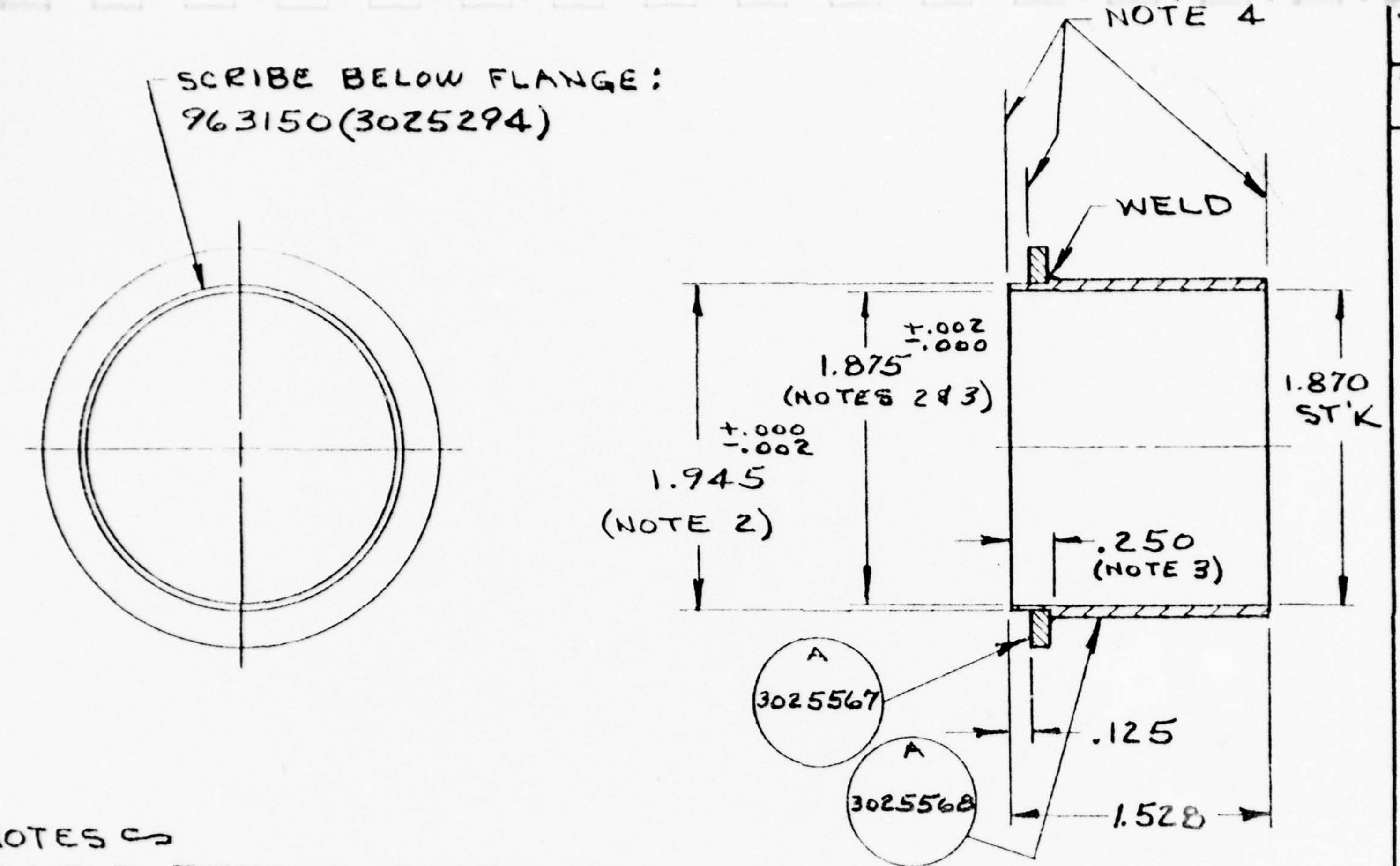
0



NOTES:

1. RUNOUT BETWEEN DIA.'S INDICATED NOT TO EXCEED .002
2. COAT WITH BLACK EMISSIVITY COATING PER SCHED. B-1

STANDARD TOLERANCE				NOTE				
BASIC DIM		FRAC	DEC	NOTE THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED	MATERIAL 304 STN STL			DWG. TITLE SPLIT RING
UP TO 6"	±	1/64	.005	SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED	PATTERN NO.	SCALE 1:1	USED ON	DESIGN BY
ABOVE 6"	±	1/32	.010					MODEL NO. J15371C
ABOVE 24"	±	1/16	.015	NOTE SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART	RCA Electronic Components EQUIPMENT DEVELOPMENT			DRAWN BY R. Niles Oct. 20, 1976
ANGULAR DIM ± 1/4°								SIZE A DWG. NO. 3025293



NOTES:

1. WELD BEFORE MACHINING
2. RUNOUT BETWEEN DIA.'S INDICATED NOT TO EXCEED .002
3. TOL. TO BE HELD OVER LENGTH SHOWN
4. SURFACES TO BE PARALLEL & PERPENDICULAR TO ℄
5. COAT WITH BLACK EMISSIVITY COATING PER SCHED. B-1

CHECKED BY	
APPROVED BY	0

STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.

SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED.

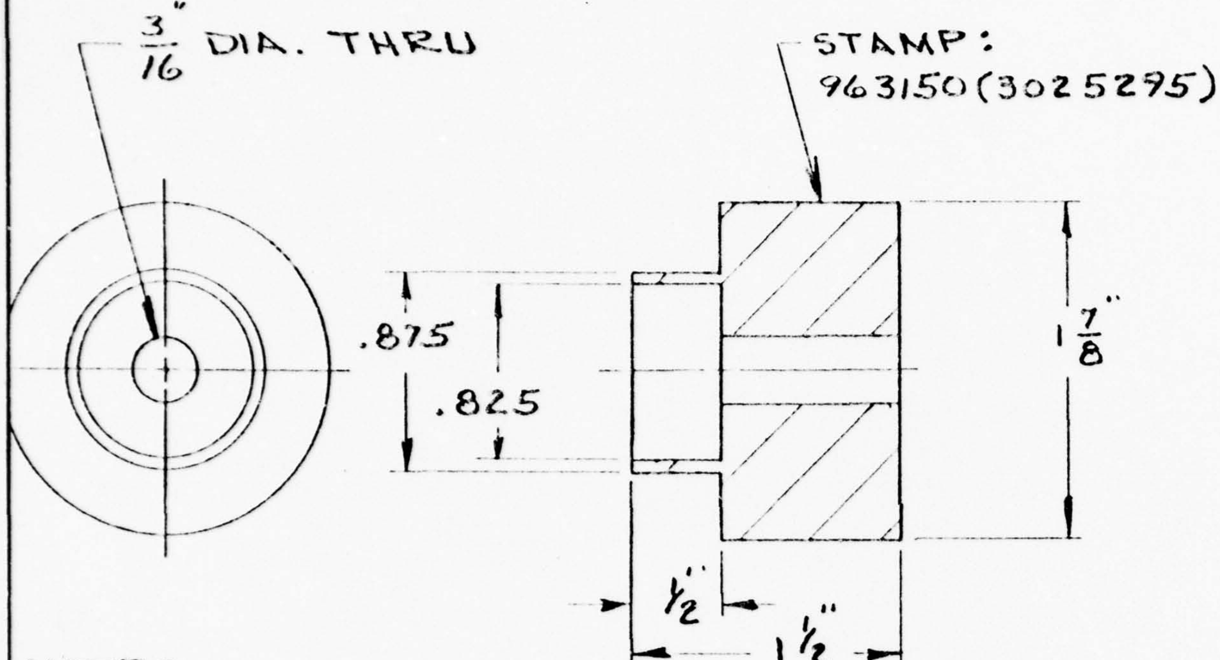
NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

MATERIAL: H			DWG TITLE: SLEEVE ASS'Y
PATTERN NO.	SCALE: 1:1	USED ON	DESIGN BY
RCA Electronic Components	EQUIPMENT DEVELOPMENT		DRAWN BY: R. Miles Oct. 20, 1976

MODEL NO. J15371C

SIZE A — DWG NO. 3025294

CHECKED BY	
APPROVED BY	0



NOTES:
1. COAT WITH BLACK EMISSIVITY COATING PER SCHED. B-1

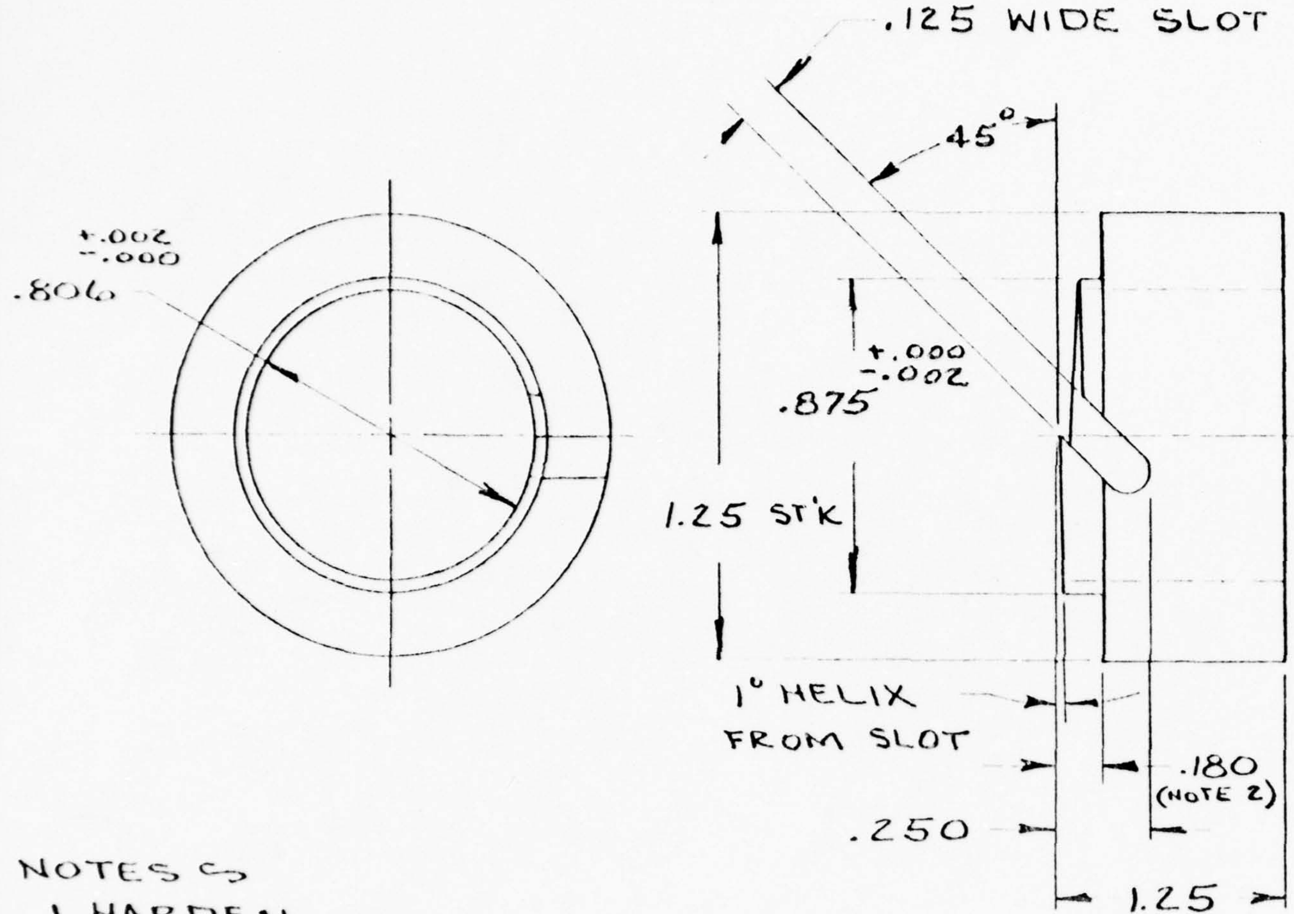
STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED

SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

MATERIAL	304 STN STL	DWG TITLE	WEIGHT
PATTERN NO	SCALE 1:1	USED ON	
DESIGN BY		MODEL NO	J15371C
RCA Electronic Components EQUIPMENT DEVELOPMENT	DRAWN BY R. Miles Sept. 13, 1976	SIZE A	DWG NO 3025295



NOTES:
1. HARDEN
2. CUTTER MAY BE RESHARPENED UNTIL .180 DIM. IS REDUCED TO .135

STANDARD TOLERANCE

NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED

SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART

MATERIAL: STENTOR

PATTERN NO:

SCALE: 2:1

USED ON:

RCA Electronic Components — EQUIPMENT DEVELOPMENT

DWG. TITLE: WICK TRIMMER

DESIGN BY:

DRAWN BY:

MODEL NO.: J15371C

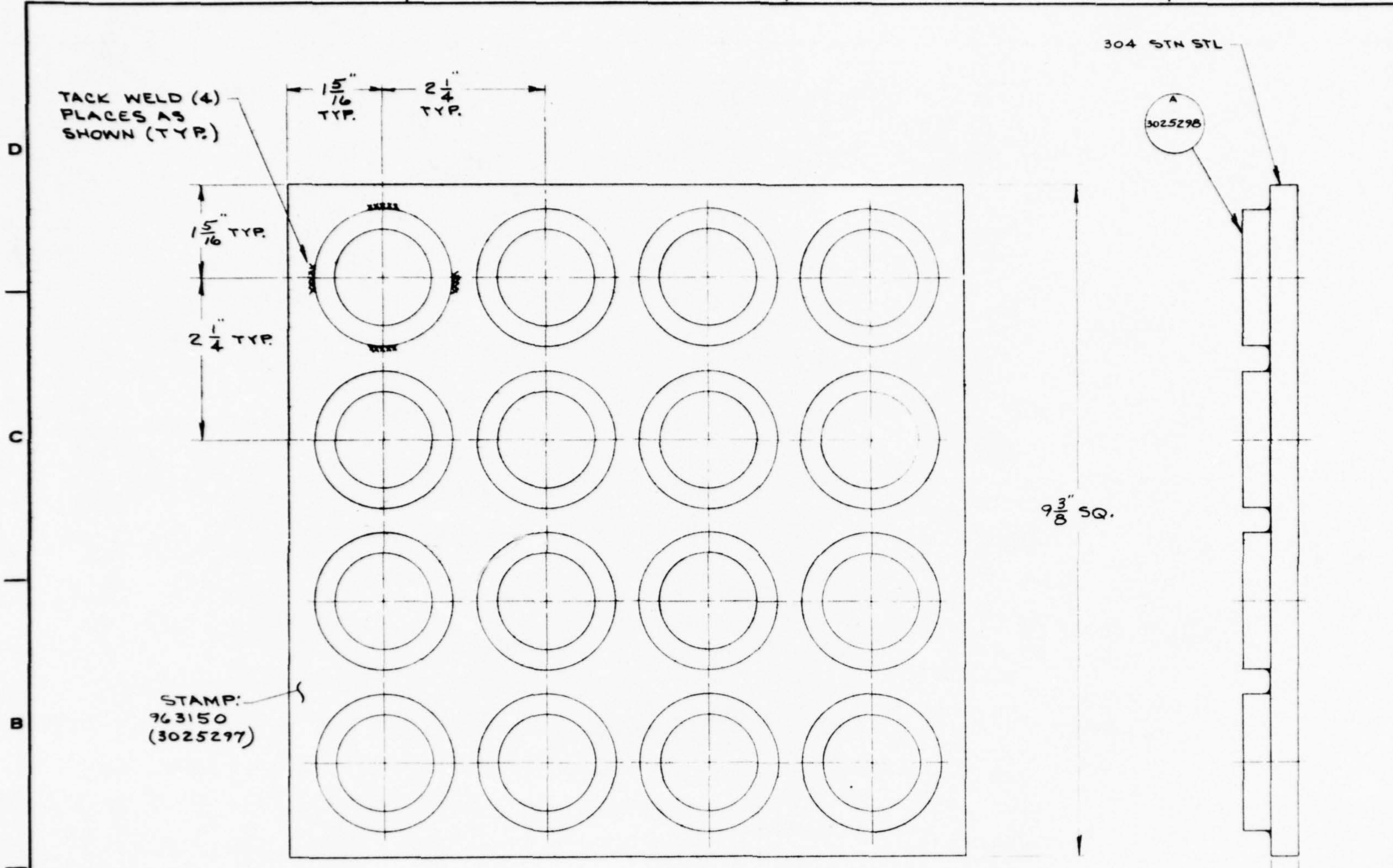
SIZE: A

DWG NO.: 3025296

CHECKED BY:

APPROVED BY:

0

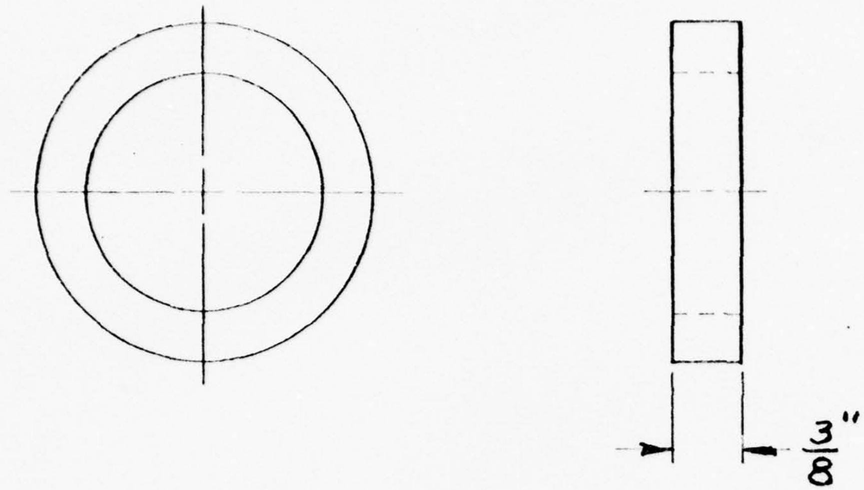


NOTES:
1. DO NOT ALLOW PLATE WARPAGE DURING WELDING

STANDARD TOLERANCE				NOTES	MATERIAL			DWG TITLE	
BASIC DIM		FRAC	DEC	NOTE THREADS EXTERNAL CLASS 2A, INTERNAL CLASS 2B (AMERICAN STD) UNLESS OTHERWISE SPECIFIED	CH			BASE	
UP TO 6"	±	1/64	.005	SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED	PATTERN NO	SCALE 1:1	USED ON	DESIGN BY	MODEL NO J15371C
ABOVE 6"	±	1/32	.010						
ABOVE 24"	±	1/16	.015	NOTE SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART	RCA Electronic Components	EQUIPMENT DEVELOPMENT		DRAWN BY R. Miles Sept. 20 1972	SIZE C DWG NO 3025297
ANGULAR DIM ± 1/2°									

REVISIONS
CHECKED BY
APPROVED BY
0

BRUNING 40-22 19782



NOTES
1. ENDS TO BE FLAT & PARALLEL WITHIN .005

MAT'L STN STL - $1\frac{1}{2}$" I.P.S PIPE x SCHED. 160 OR $1\frac{1}{2}$" O.D. x .083 WALL TUBING

CHECKED BY			
APPROVED BY			0

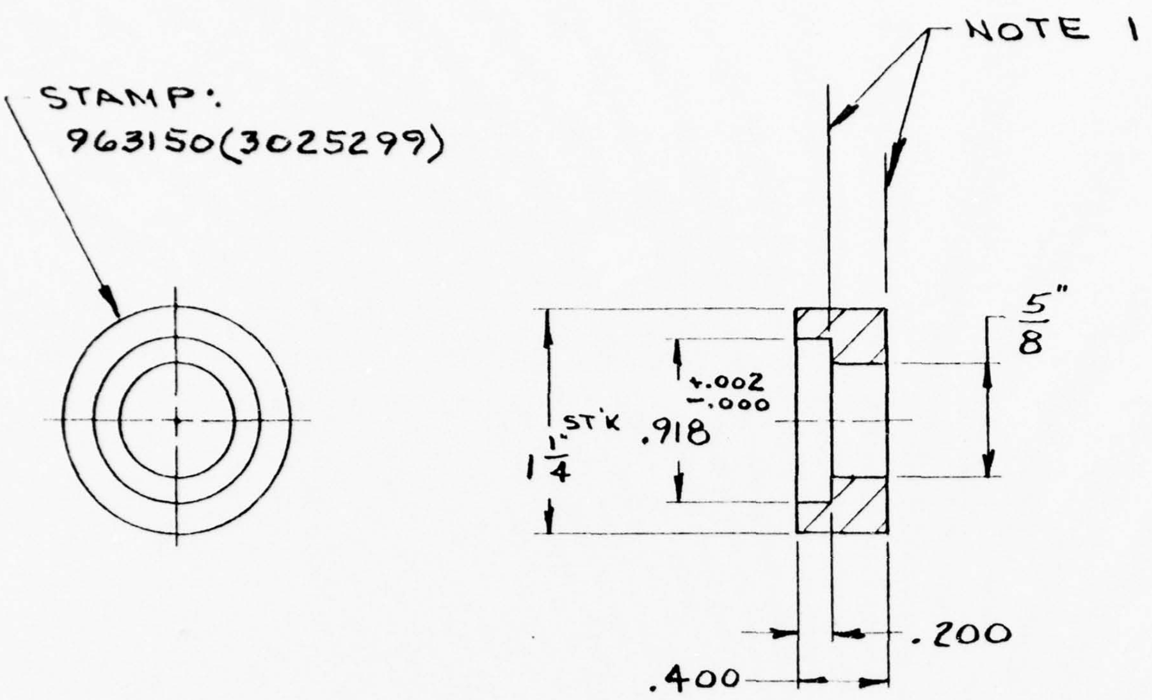
STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED

SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART

MATERIAL: SEE ABOVE			DWG TITLE: SLEEVE	
PATTERN NO	SCALE: 1:1	USED ON	DESIGN BY	MODEL NO. J15371C
RCA Electronic Components — EQUIPMENT DEVELOPMENT			DRAWN BY: R. Miles Sept. 20, 1976	SIZE: A — DWG. NO. 3025298



NOTES:
1. SURFACES TO BE FLAT WITHIN .002 & PARALLEL WITHIN .002

STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED

SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART

MATERIAL: MOLY (1 1/4" DIA.)

DWG TITLE: SUPPORT

PATTERN NO:

SCALE: 1:1

USED ON:

DESIGN BY:

MODEL NO: J15371C

RCA Electronic Components — EQUIPMENT DEVELOPMENT

DRAWN BY: R. Mile, Sept. 20, 1976

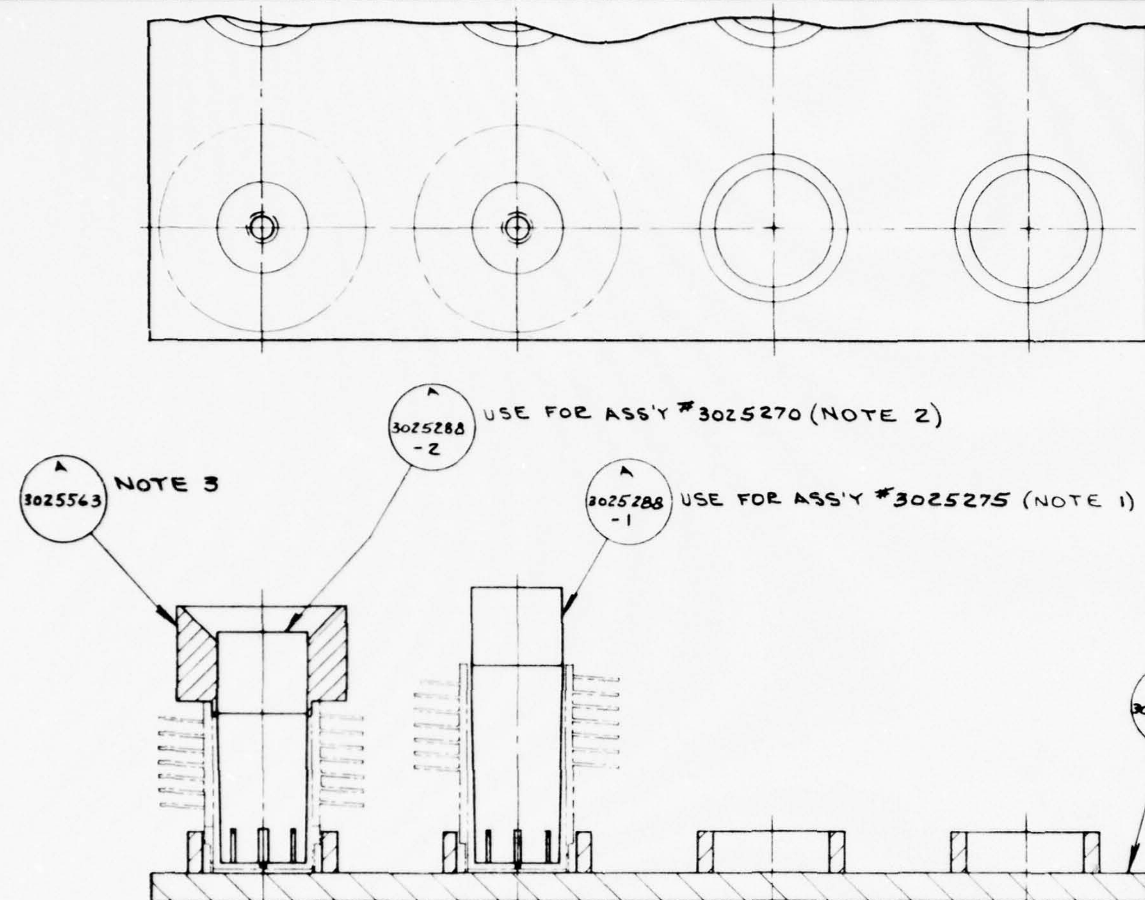
SIZE: A

DWG NO: 3025299

CHECKED BY:

APPROVED BY:

0



NOTES:
1. DO NOT REMOVE MANDREL UNTIL NEXT BRAZED ASS'Y (#3025276) IS COMPLETED
2. DO NOT REMOVE MANDREL UNTIL NEXT BRAZED ASS'Y (#3025271) IS COMPLETED
3. REMOVE FUNNEL AFTER POURING WICKING MAT'L

REVISIONS	
CHECKED BY	
APPROVED BY	O

STANDARD TOLERANCE		FRAC.	DEC.
BASIC DIM.		FRAC.	DEC.
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM.	±	1/2°	

NOTE: THREADS EXTERNAL, CLASS 2A; INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.

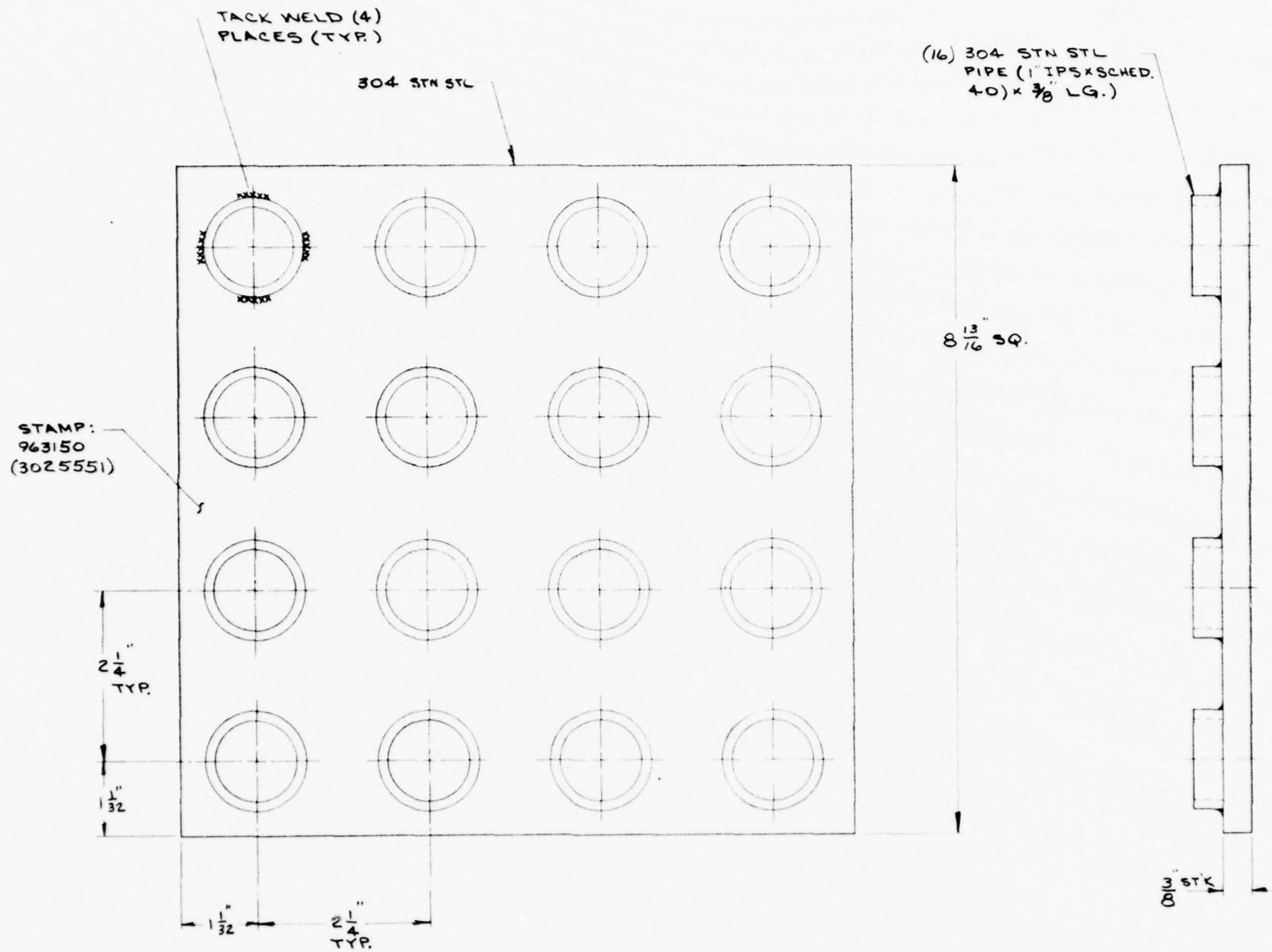
SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED.

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

MATERIAL			DWG. TITLE	
CH			ANODE & CATH. WICKING HOLDER	
PATTERN NO.	SCALE 1:1	USED ON	DESIGN BY	MODEL NO. J15371C
RADIO CORPORATION OF AMERICA ~~EQUIPMENT DEVELOPMENT~~			DRAWN BY R. Miles Sept. 22, 1976	SIZE B DWG. NO. 3025300

T 660 12/56

DEFIANCE NO. 1020P-8 470



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STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL CLASS 2A, INTERNAL CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED

SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART

MATERIAL: SEE ABOVE

DWG TITLE: BASE

PATTERN NO.

SCALE: 1:1

USED ON

DESIGN BY

MODEL NO: J15371C

RCA Electronic Components — EQUIPMENT DEVELOPMENT

DRAWN BY: R. Miles Sept. 24 1976

SIZE: C

DWG NO: 3025551

REVISIONS

CHECKED BY

APPROVED BY

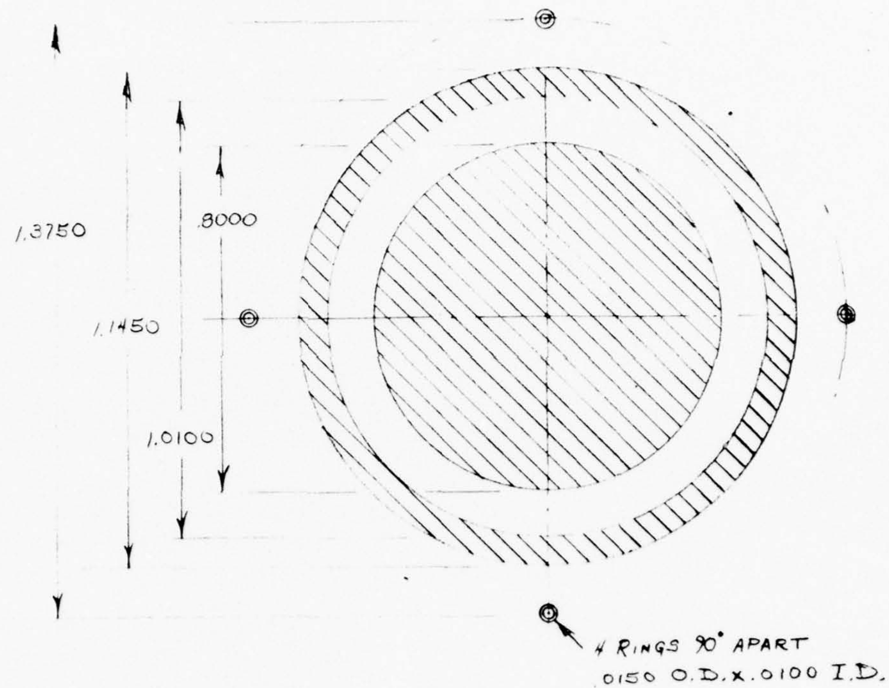
0

BRUNING 40-22 19762

DIMENSIONS ARE IN INCHES AND INCLUDE THICKNESS OF PLATING. DO NOT SCALE DRAWING. ALL EXTERNAL THREADS TO BE CLASS 2A BEFORE PLATING AND CLASS 2 AFTER PLATING, ALL INTERNAL THREADS TO BE CLASS 2B, UNLESS OTHERWISE SPECIFIED.

NOTES:

1. AREA CROSS HATCHED IS OPAQUE ON MASK
2. PRINT MASK IN CENTER OF A 2"x2" GLASS SLIDE
3. TOLERANCE ON MASK ARE ±.0002 FOR ALL DIMENSIONS
4. THIS MASK IS REFERRED TO AS MASK 'D' ON PROCESS SHEETS



REVISIONS	
AP. BY	0
DATE	
DWG. NO. WAS 9638100-42; NOTE 3 WAS ±.0001; ADDED NOTE 4 R. Miles Dec. 1, 1976	1

VARIATIONS ON FINISHED DIMENSIONS UNLESS OTHERWISE MARKED		
BASIC DIMENSIONS	2 PLACE DECIMALS	3 PLACE DECIMALS
UP TO 6	± .02	± .005
ABOVE 6 TO 24	± .03	± .010
ABOVE 24	± .06	± .015
ANGULAR DIMENSIONS ± 1/2 DEG.		
SEE PURCH. SPEC. FOR STOCK TOLERANCE		

EMITTER-GATE INSULATION MASK
400 AMP TRANSCALENT THYRISTOR

FIRST MADE FOR — USED ON

DRAWN BY S.W. Kessler — CHECKED BY

DESIGNED BY S.W. Kessler — COMMODITY CODE

RCA — RCA CORPORATION — Sept 25, 1972

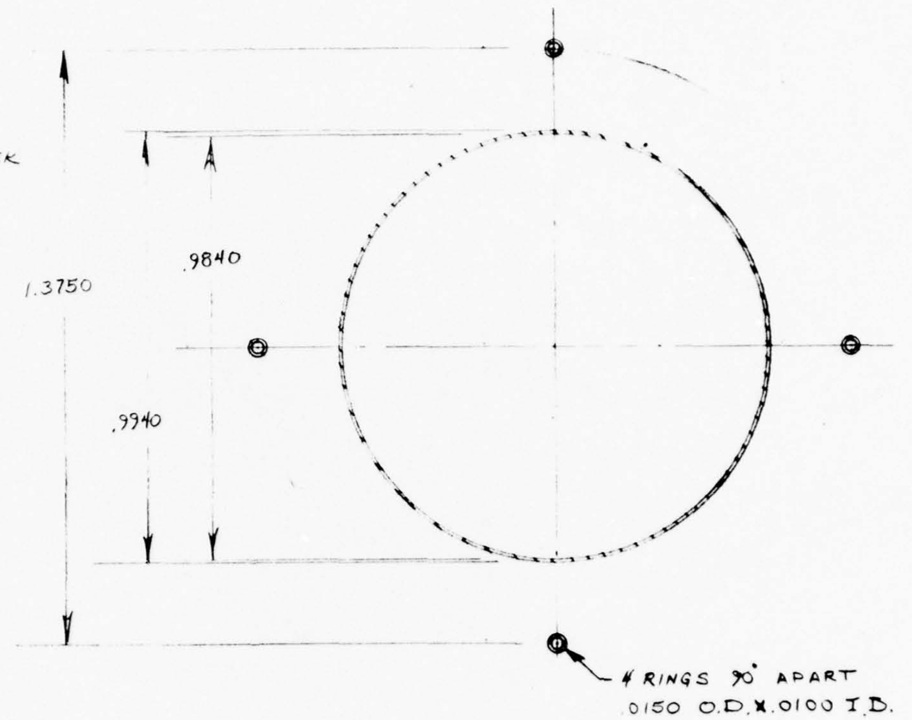
CODE IDENT NO. 49671

B — 3025553AR1 — SIZE — SHEET — CONT'D ON SH

3025553AR1

DIMENSIONS ARE IN INCHES AND INCLUDE THICKNESS OF PLATING. DO NOT SCALE DRAWING. ALL EXTERNAL THREADS TO BE CLASS 2A BEFORE PLATING AND CLASS 2 AFTER PLATING, ALL INTERNAL THREADS TO BE CLASS 2B, UNLESS OTHERWISE SPECIFIED.

NOTES:
1. THIS MASK IS REFERRED TO AS MASK 'E' ON PROCESS SHEETS
2. AREA CROSS HATCHED IS OPAQUE ON MASK
3. PRINT MASK IN CENTER OF A 2"x2" GLASS SLIDE.
4. TOLERANCES ON MASK ARE ±.0002 FOR ALL DIMENSIONS.



REVISIONS

AP. BY
DATE
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NOTE 1 WAS: SELECT RUBYLITH CUTTING SO THAT ALL AREA OUTSIDE A DIA. OF 1.0950 MAY BE OPAQUE IN A FUTURE DWG. WITH THE RING SHOWN IN THIS DWG. ON IT.; NOTE 4 WAS ±.0001; DWG. NO. WAS 9638100-5

R. Miles Dec. 1, 1976 1

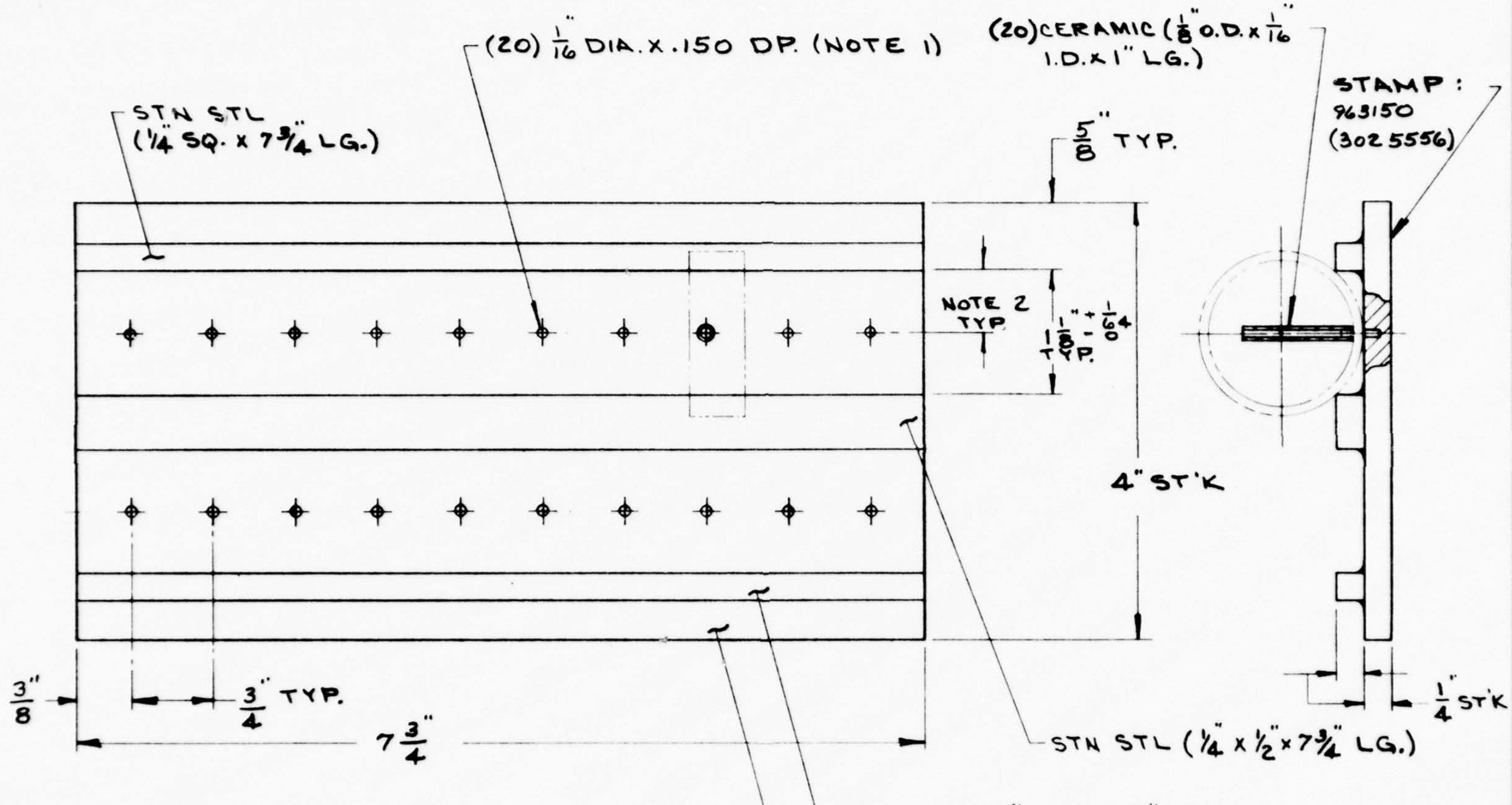
VARIATIONS ON FINISHED DIMENSIONS UNLESS OTHERWISE MARKED		
BASIC DIMENSIONS	2 PLACE DECIMALS	3 PLACE DECIMALS
UP TO 6	± .02	± .005
ABOVE 6 TO 24	± .03	± .010
ABOVE 24	± .06	± .015
ANGULAR DIMENSIONS ± 1/2 DEG		
SEE PURCH. SPEC. FOR STOCK TOLERANCE		

EMITTER METALLIZING ETCH MASK
400 AMP TRANSCALENT THYRISTOR

FIRST MADE FOR
USED ON
DRAWN BY S.M. Kessler
CHECKED BY
DESIGNED BY S.M. Kessler
COMMODITY CODE
RCA — RCA CORPORATION
Sept 25, 1972
CODE IDENT NO. 49671
B SIZE
3025554AR1
SHEET CONT'D ON SH

3025554AR1

RCA 408-2 REV. 1 9-69 PRINTED IN U.S.A.



NOTES:
1. HOLES TO BE SAME DEPTH WITHIN .005
2. HOLES TO BE CENTERED IN 1 1/8" SPACE
3. BARS TO BE TACK WELDED TO PLATE

REVISIONS	
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APPROVED BY	0

STANDARD TOLERANCE		FRAC	DEC
BASIC DIM.			
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM.	±	1/2°	

NOTE: THREADS EXTERNAL, CLASS 2A; INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.

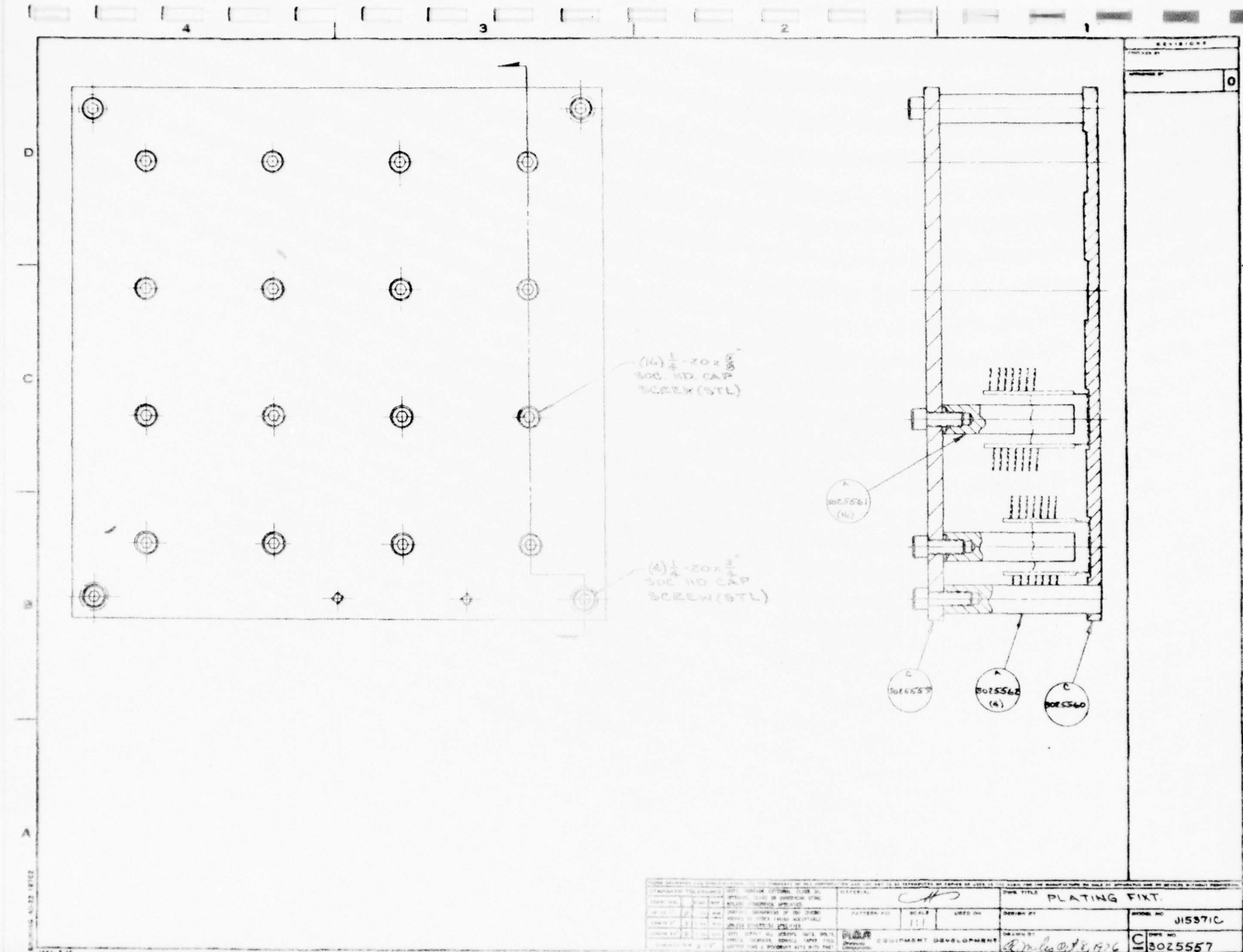
SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED.

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

MATERIAL: SEE ABOVE			DWG. TITLE: CERAMIC INS. ASS'Y BRAZING FIXT.
PATTERN NO.	SCALE: 1:1	USED ON	DESIGN BY / MODEL NO. J15371C
RADIO CORPORATION OF AMERICA — EQUIPMENT DEVELOPMENT			DRAWN BY: R. Miles Oct. 15, 1976 / SIZE B / DWG. NO. 3025556

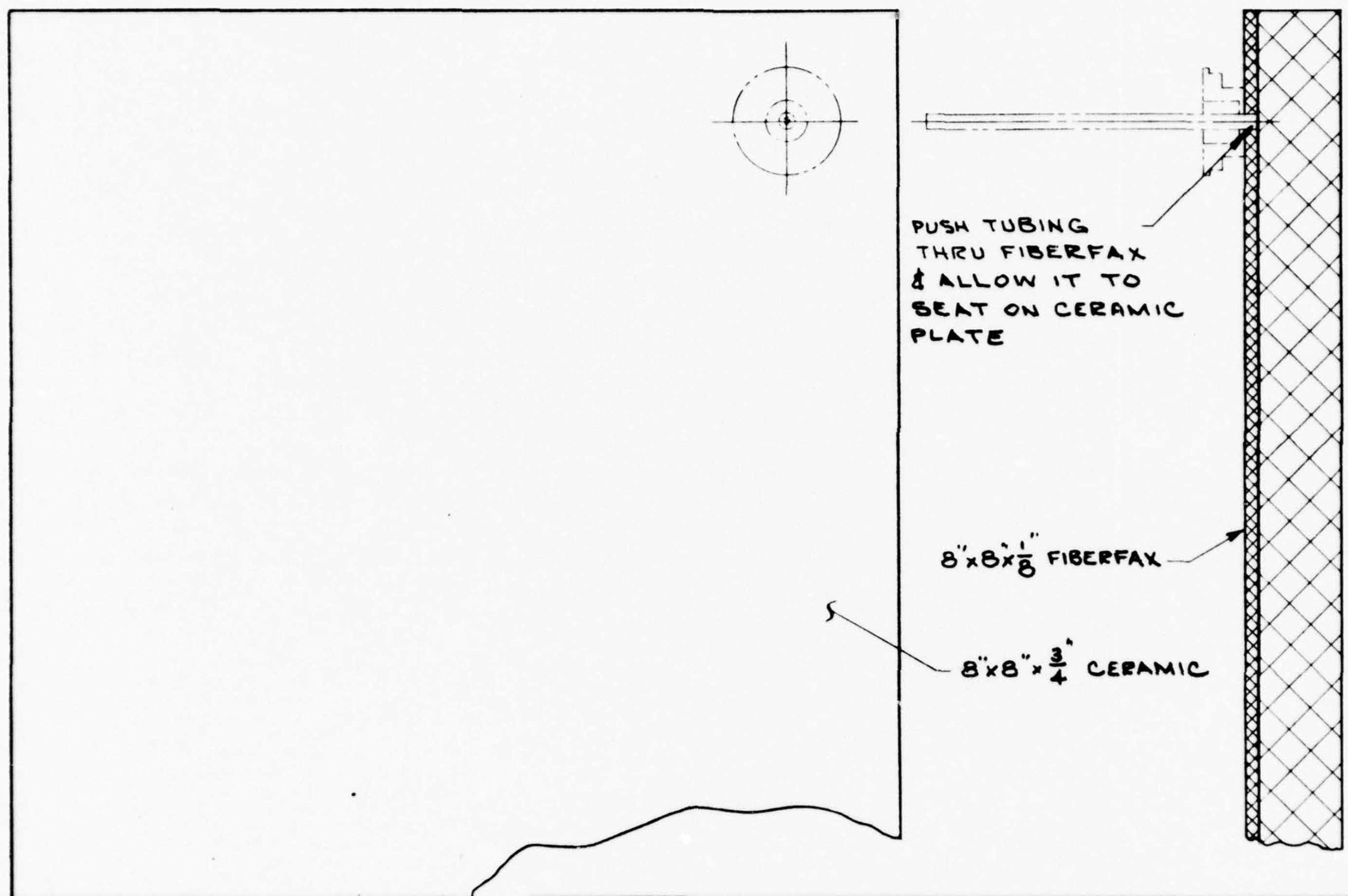
T 660 12/56

DEFIANCE NO. 1080F-8 470



(16) 1/4-20 x 5/8 SOC. HD. CAP SCREW (STL)
(4) 1/4-20 x 3/4 SOC. HD. CAP SCREW (STL)
A 3025561 (16)
C 3025559
A 3025562 (4)
C 3025560
PLATING FIXT.
J15371C
EQUIPMENT DEVELOPMENT
SCALE 1:1
C 3025557

REVISIONS	
CHECKED BY	
APPROVED BY	O



STANDARD TOLERANCE			
BASIC DIM.		FRAC.	DEC.
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM.	±	1/2°	

NOTE: THREADS EXTERNAL, CLASS 2A; INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.

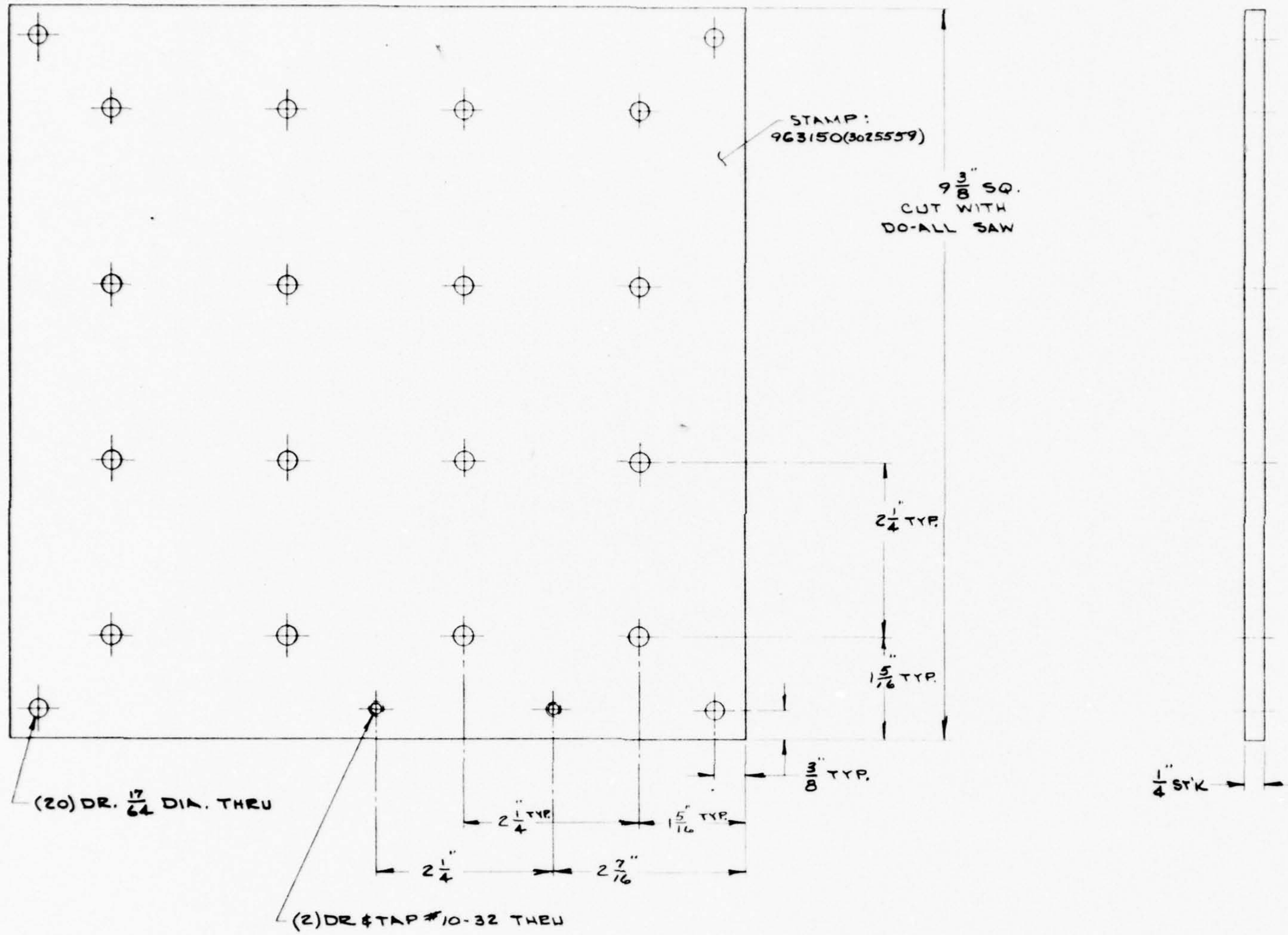
SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED.

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

MATERIAL CHS			DWG. TITLE END CAP ASS'Y BRAZING FIXT.
PATTERN NO.	SCALE 1:1	USED ON	DESIGN BY
			MODEL NO. J15371C
RADIO CORPORATION OF AMERICA ~~EQUIPMENT DEVELOPMENT~~			DRAWN BY R. Niles Oct. 21, 1936
			SIZE B — DWG. NO. 3025558

T 660 12/56

DEFIANCE NO. 1080F-6 430



REVISIONS

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STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL CLASS 2A, INTERNAL CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.

SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED.

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART

MATERIAL: COPPER

PATTERN NO

SCALE: 1:1

USED ON

RCA Electronic Components EQUIPMENT DEVELOPMENT

DWG TITLE: ANODE PLATE

DESIGN BY

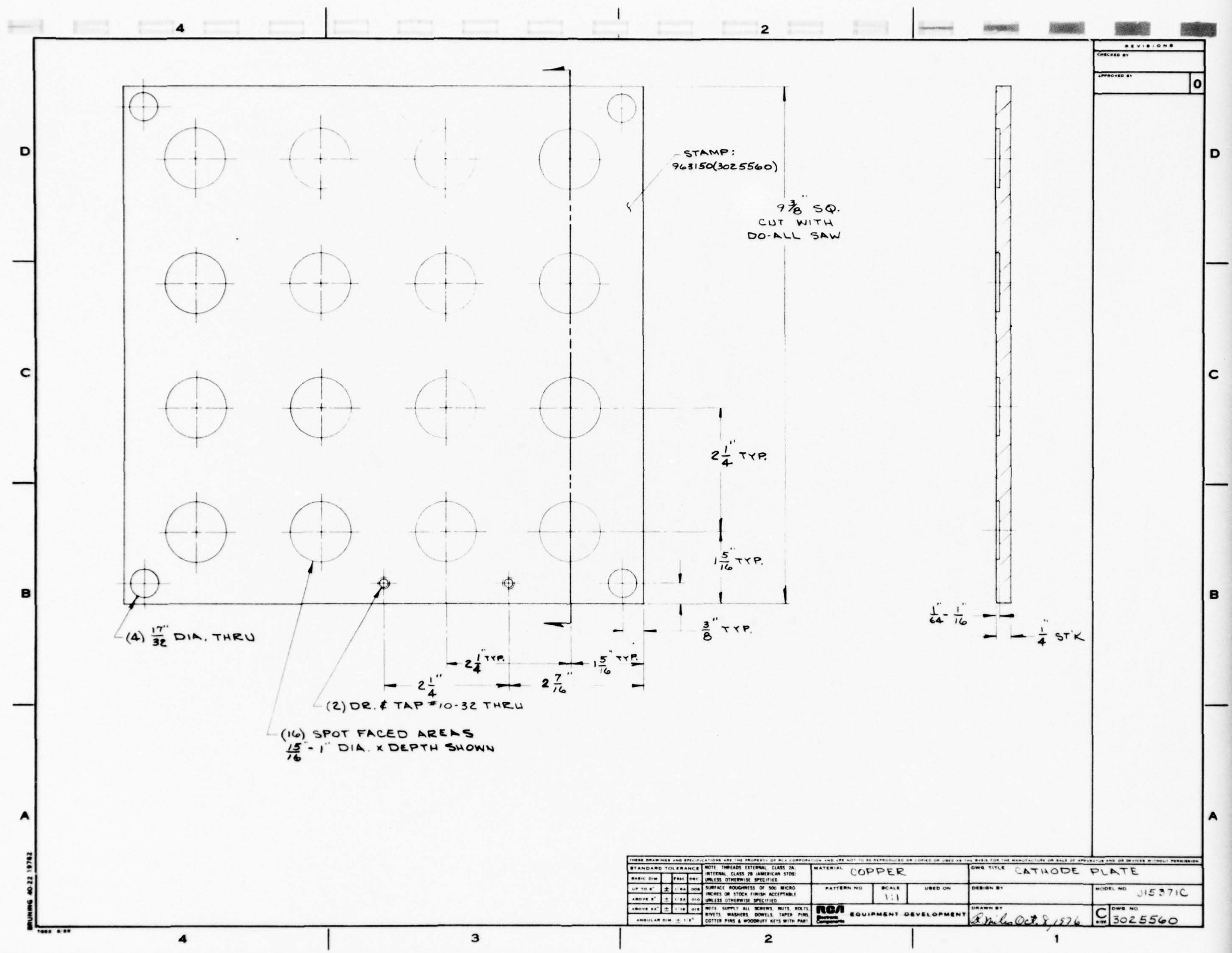
DRAWN BY: R. Melo Oct 8, 1976

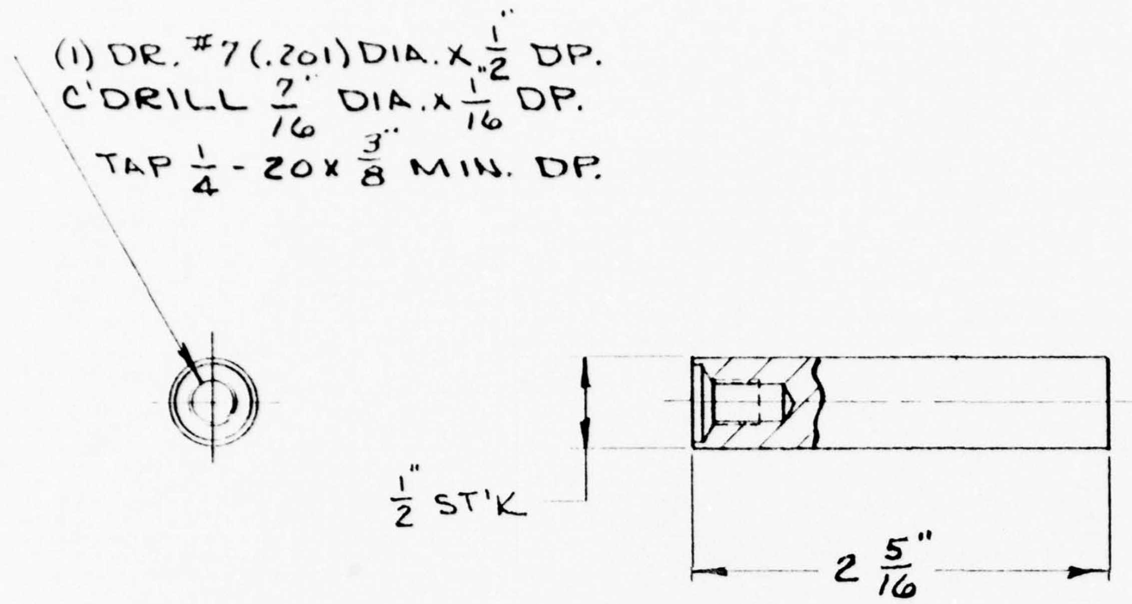
MODEL NO: J15371C

SIZE: C

DWG NO: 3025559

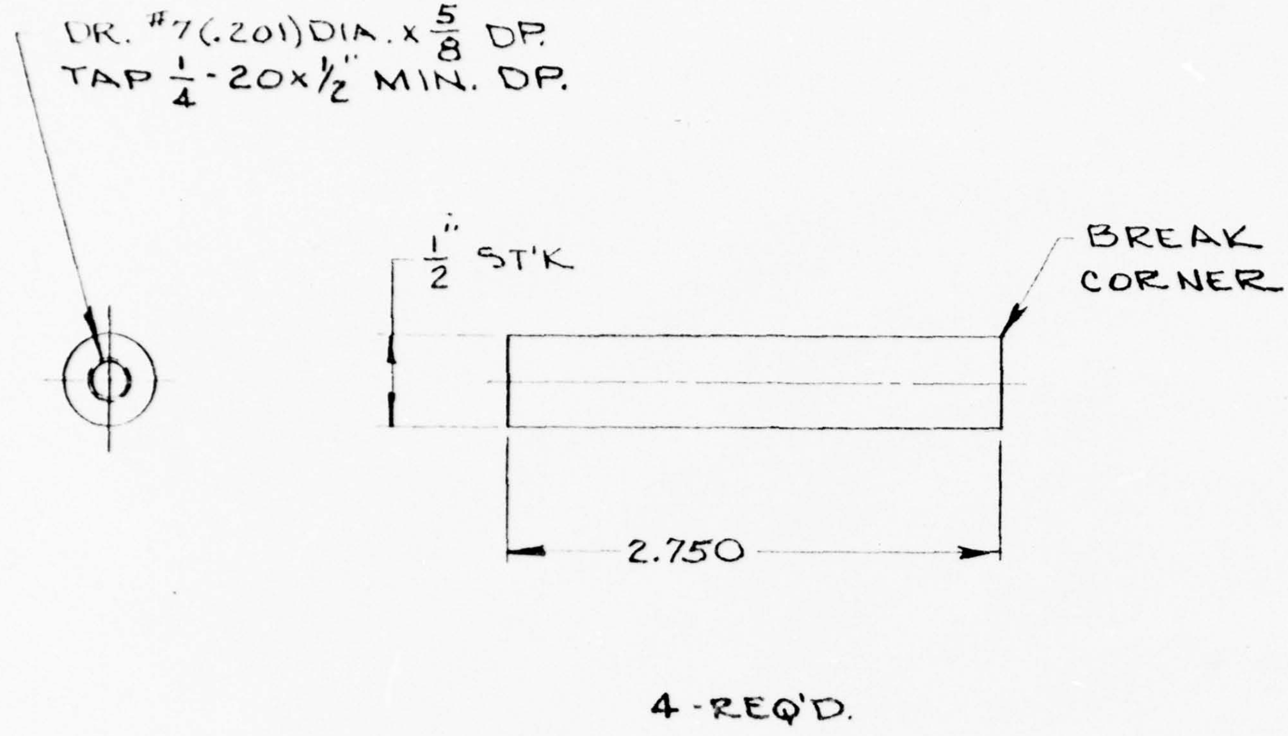
BRUNING 40-22 19782


STAMP: 963150(3025560)
9 3/8" SQ. CUT WITH DO-ALL SAW
2 1/4" TYP.
1 5/16" TYP.
3/8" TYP.
(4) 17/32" DIA. THRU
2 1/4" TYP.
1 5/16" TYP.
2 1/4"
2 7/16"
(2) DR. & TAP #10-32 THRU
(16) SPOT FACED AREAS 15/16"-1" DIA. x DEPTH SHOWN
1/64"-1/16"
1/4" ST'K
REVISIONS
CHECKED BY
APPROVED BY
0
MATERIAL COPPER
DWG TITLE CATHODE PLATE
PATTERN NO
SCALE 1:1
USED ON
DESIGN BY
MODEL NO. J15371C
RCA EQUIPMENT DEVELOPMENT
DRAWN BY R. Miles Oct. 8, 1976
C
DWG NO 3025560



CHECKED BY				
APPROVED BY				0

STANDARD TOLERANCE				NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED	MATERIAL: COPPER			DWG. TITLE: ELECTRODE	
BASIC DIM		FRAC	DEC						
UP TO 6"	±	1/64	.005	SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED	PATTERN NO.	SCALE: 1:1	USED ON	DESIGN BY	MODEL NO: J15371C
ABOVE 6"	±	1/32	.010						
ABOVE 24"	±	1/16	.015	NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART	RCA Electronic Components	EQUIPMENT DEVELOPMENT		DRAWN BY: L. Miles Oct. 11, 1976	SIZE: A DWG. NO: 3025561
ANGULAR DIM ± 1/2°									



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APPROVED BY	0

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STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.

SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED.

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

MATERIAL: BAKELITE

PATTERN NO.

SCALE: 1:1

USED ON

DWG. TITLE: POST

DESIGN BY

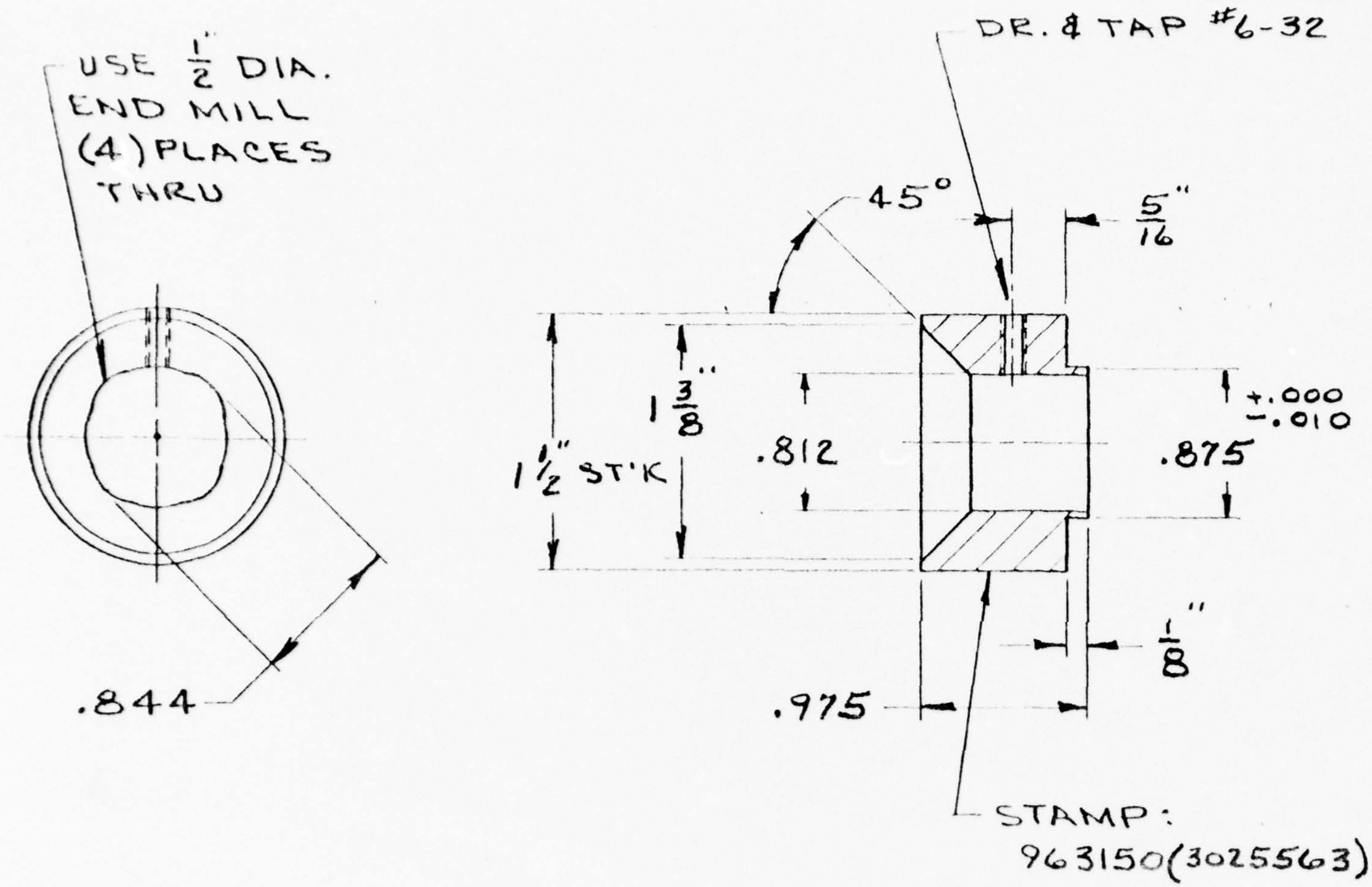
MODEL NO.: J15371C

RCA Electronic Components — EQUIPMENT DEVELOPMENT

DRAWN BY

SIZE: A

DWG. NO.: 3025562



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APPROVED BY	0

STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED

SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART

MATERIAL: C.R.S. (1 1/2" DIA.)

DWG TITLE: WICKING FUNNEL

PATTERN NO: | SCALE: 1:1 | USED ON:

DESIGN BY:

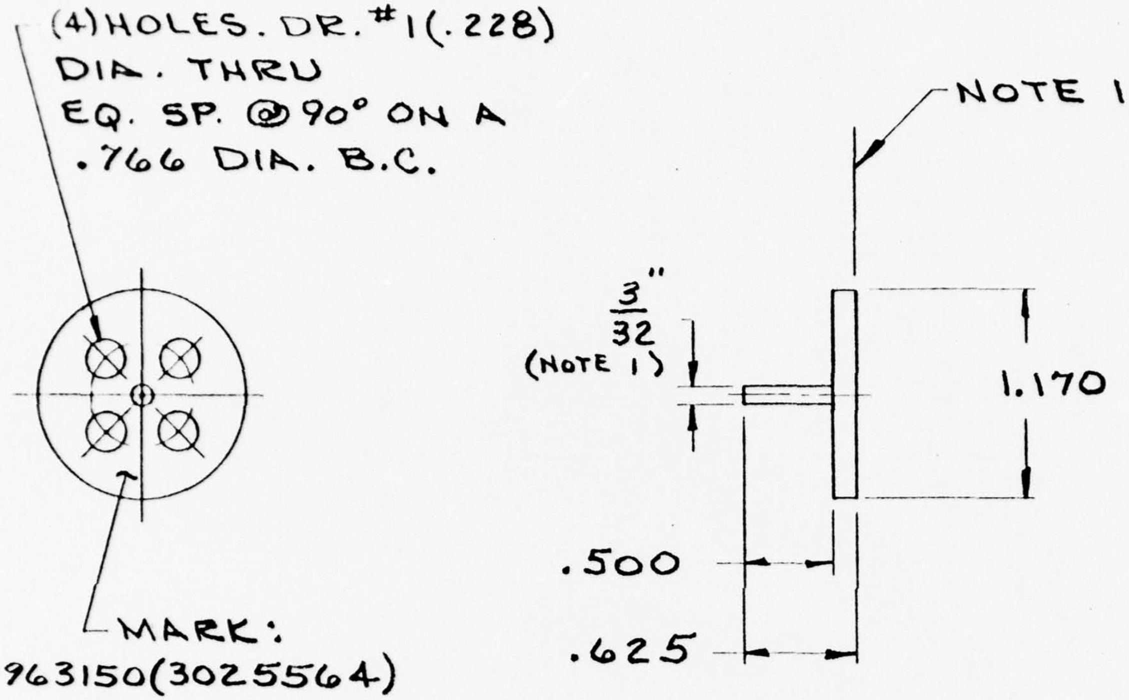
MODEL NO: J15371C

RCA Electronic Components — EQUIPMENT DEVELOPMENT

DRAWN BY: R. Miles Oct 15, 1976

SIZE: A | DWG NO: 3025563

CHECKED BY	
APPROVED BY	0



NOTES:
1. SURFACE MUST BE PERPENDICULAR TO SHAFT

STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

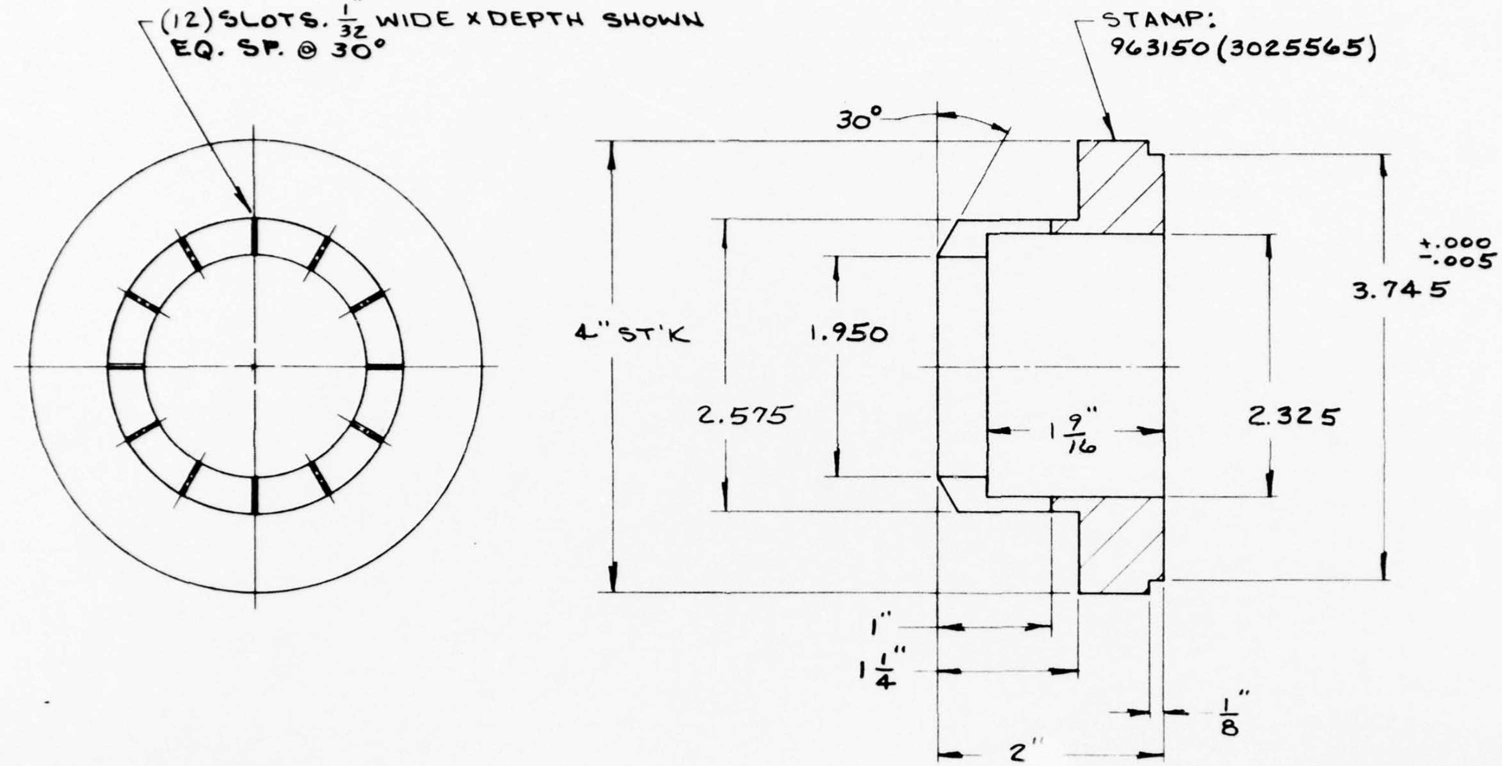
NOTE: THREADS EXTERNAL, CLASS 2A; INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.

SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED.

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

MATERIAL 304 STN STL		
PATTERN NO.	SCALE 1:1	USED ON
RCA Electronic Components EQUIPMENT-DEVELOPMENT		

DWG. TITLE WAFER CONTOURING MANDREL		
DESIGN BY	MODEL NO. J15371C	
DRAWN BY R. Miles Oct. 18, 1976	SIZE A	DWG. NO. 3025564



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STANDARD TOLERANCE			
BASIC DIM.		FRAC.	DEC.
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM.	±	1/2°	

NOTE: THREADS EXTERNAL, CLASS 2A; INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.

SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED.

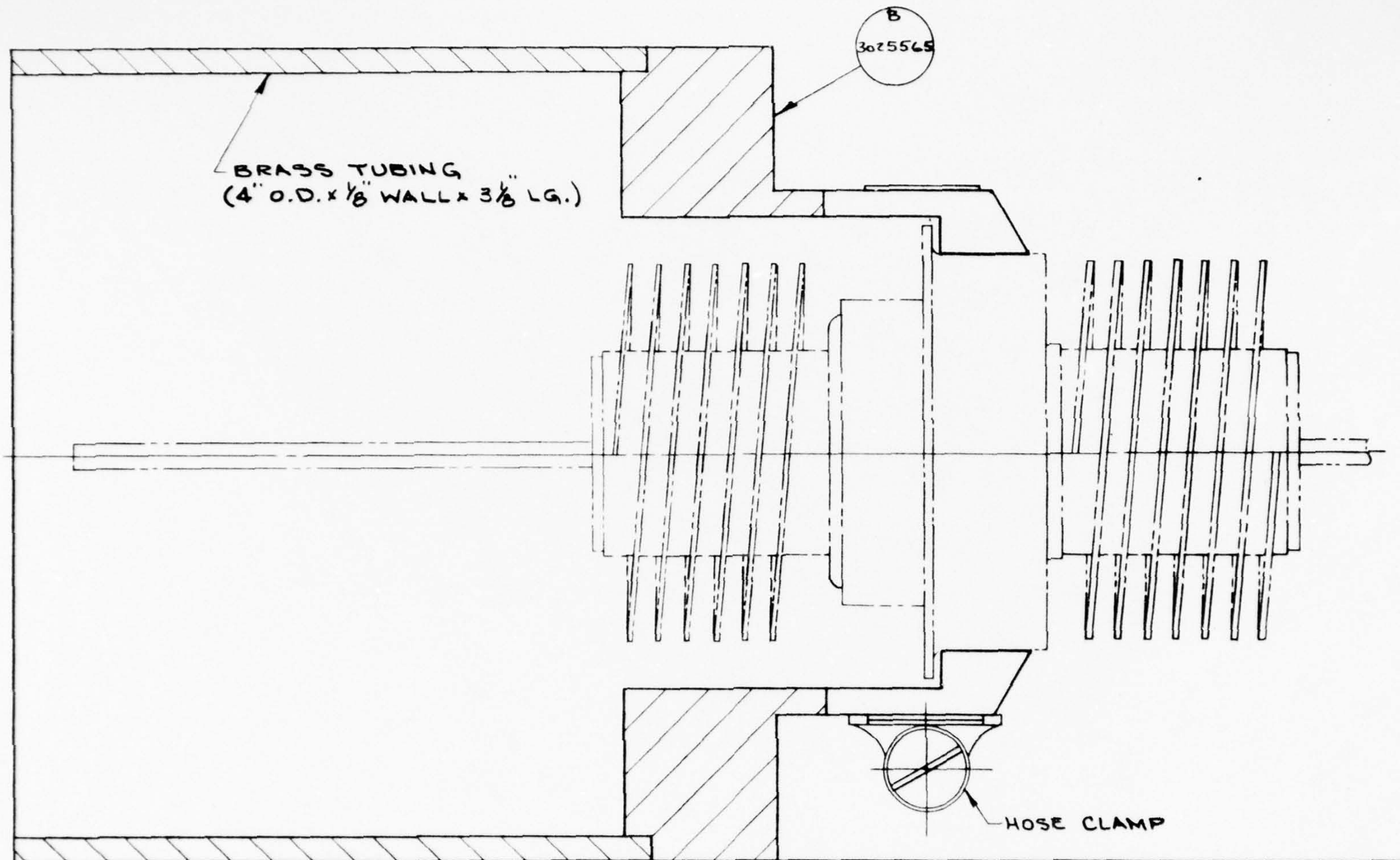
NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

MATERIAL	COPPER
PATTERN NO.	
SCALE	1:1
USED ON	
DWG. TITLE	CLAMP RING
DESIGN BY	
MODEL NO.	J15371C
DRAWN BY	R. Mil... Oct. 19, 1976
SIZE	B
DWG. NO.	3025565

RADIO CORPORATION OF AMERICA
~~EQUIPMENT DEVELOPMENT~~

T 660 12/56

DEFIANCE NO. 1020F-8 470



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STANDARD TOLERANCE			
BASIC DIM.		FRAC.	DEC.
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM.	±	1/2°	

NOTE: THREADS EXTERNAL, CLASS 2A; INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.

SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED.

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

MATERIAL: H

PATTERN NO.

SCALE: 2:1

USED ON

RADIO CORPORATION OF AMERICA

~~EQUIPMENT DEVELOPMENT~~

DWG. TITLE: WELDING HEAT SINK

DESIGN BY

MODEL NO. J15371C

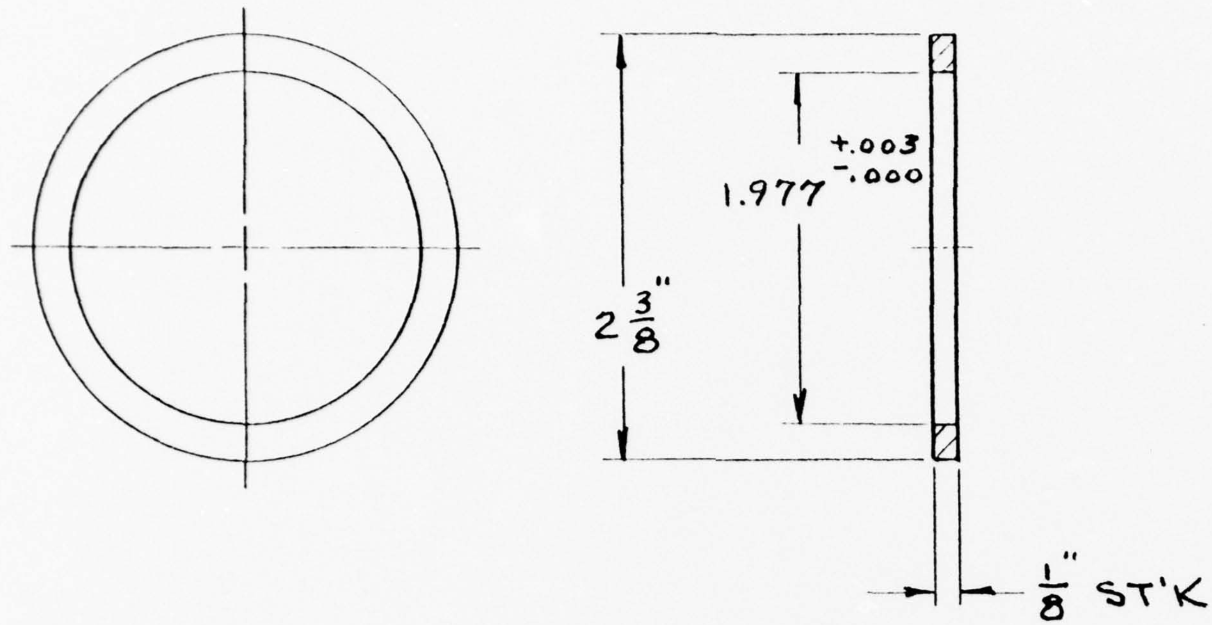
DRAWN BY: R. Miles Oct. 19, 1976

SIZE: B

DWG. NO. 30255666

T 660 12/56

DEFIANCE NO. 1080F-8 470



CHECKED BY

APPROVED BY

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STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.

SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART

MATERIAL 304 STN STL

DWG. TITLE FLANGE

PATTERN NO.

SCALE 1:1

USED ON

DESIGN BY

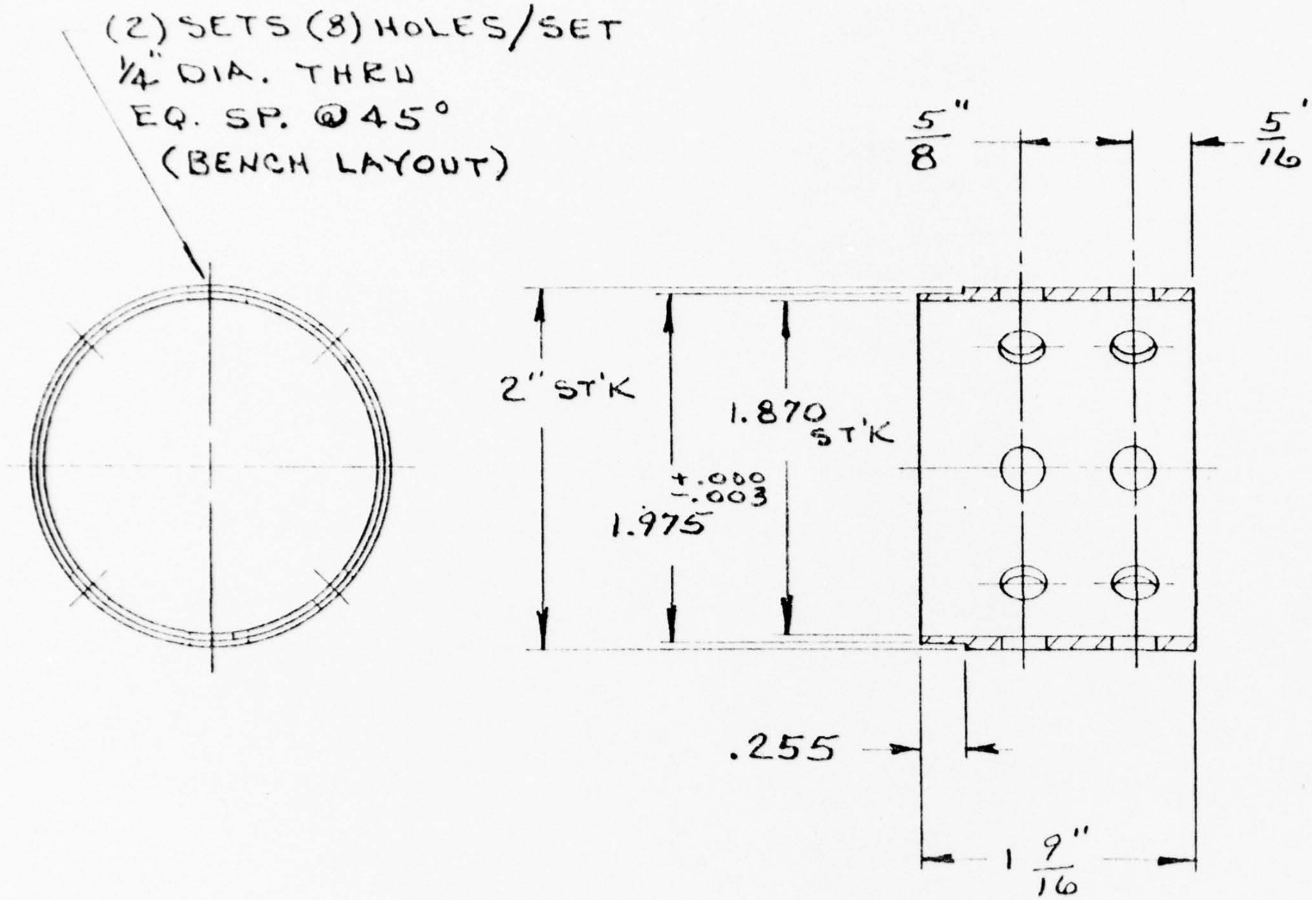
MODEL NO. J15371C

RCA Electronic Components EQUIPMENT DEVELOPMENT

DRAWN BY R. Nicolo Oct. 21, 1976

A SIZE

DWG. NO. 3025567



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APPROVED BY	0

STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED

SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART

MATERIAL 304 STN STL TUBING (2.000 O.D. x .065 WALL)

PATTERN NO.	SCALE	USED ON
	1:1	

RCA Electronic Components — EQUIPMENT DEVELOPMENT

DWG. TITLE: SLEEVE

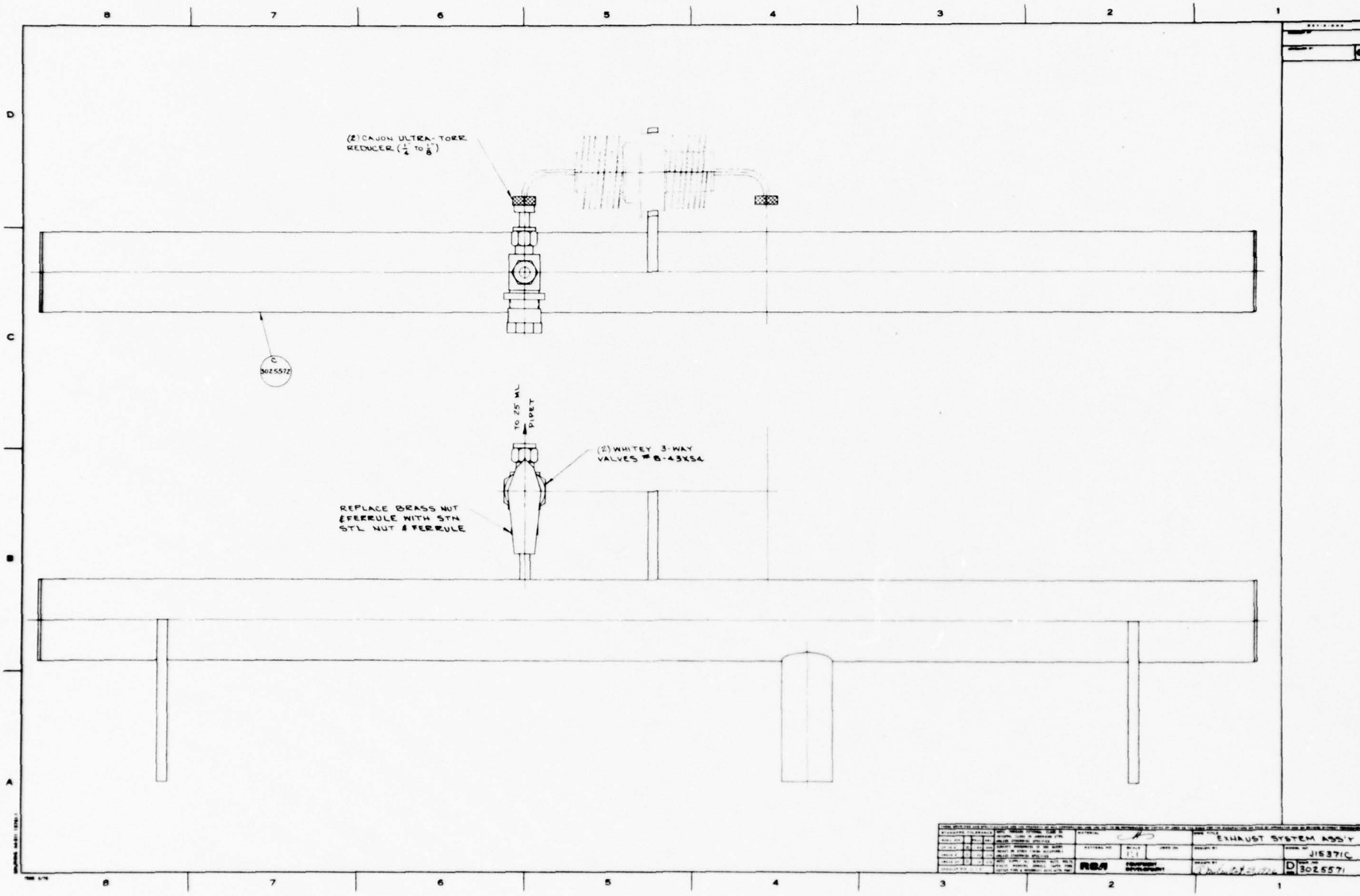
DESIGN BY

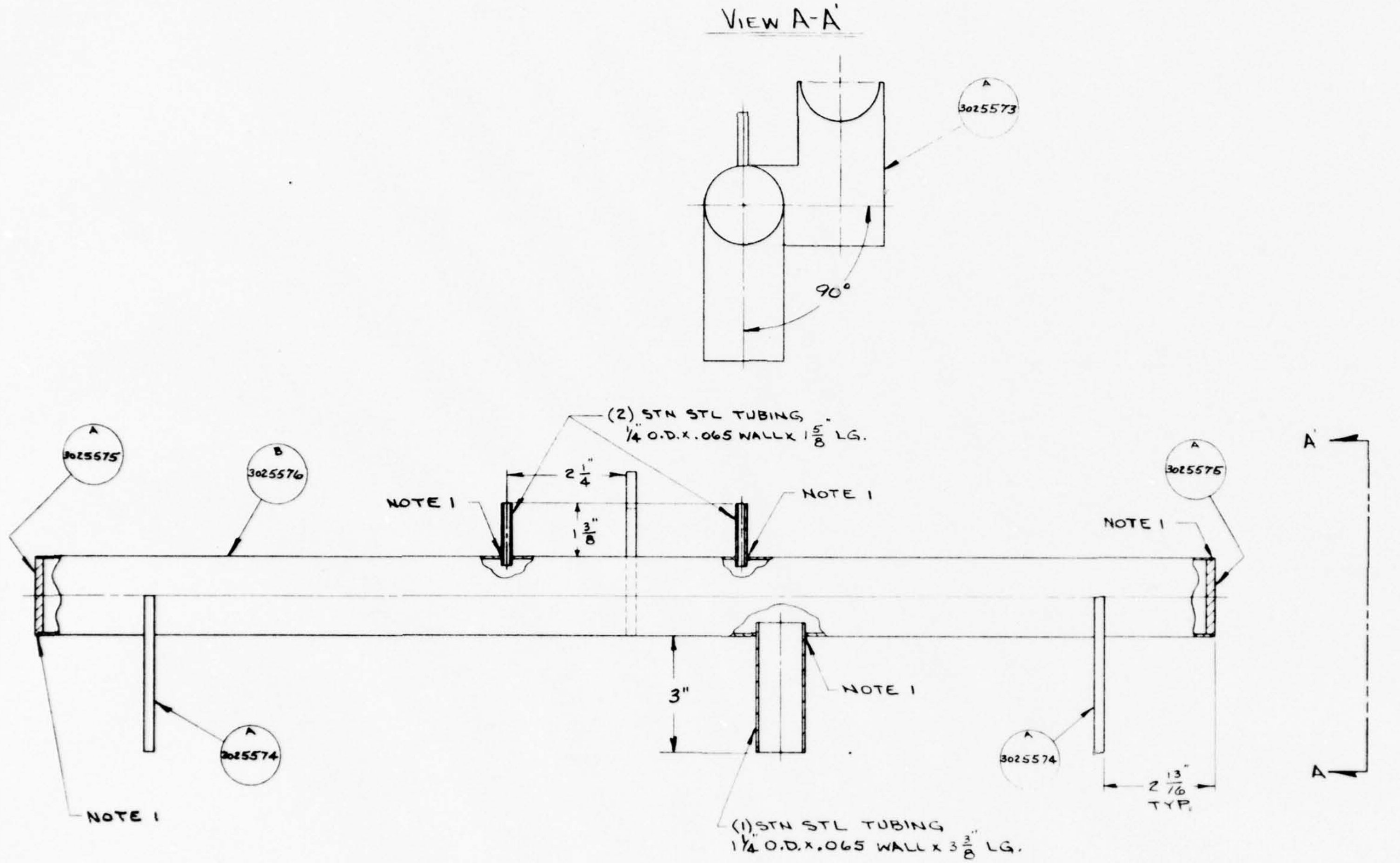
DRAWN BY: R. Miles, Oct. 20, 1976

MODEL NO.: J1537IC

SIZE: A

DWG. NO.: 3025568


(2) CAJON ULTRA-TORR
REDUCER ($\frac{1}{4}$" TO $\frac{1}{8}$")
C
3025572
TO 25 ML
PIPET
(2) WHITEY 3-WAY
VALVES # B-43XS4
REPLACE BRASS NUT
& FERRULE WITH STN
STL NUT & FERRULE
EXHAUST SYSTEM ASS'Y
J15371C
D
3025571
RCA



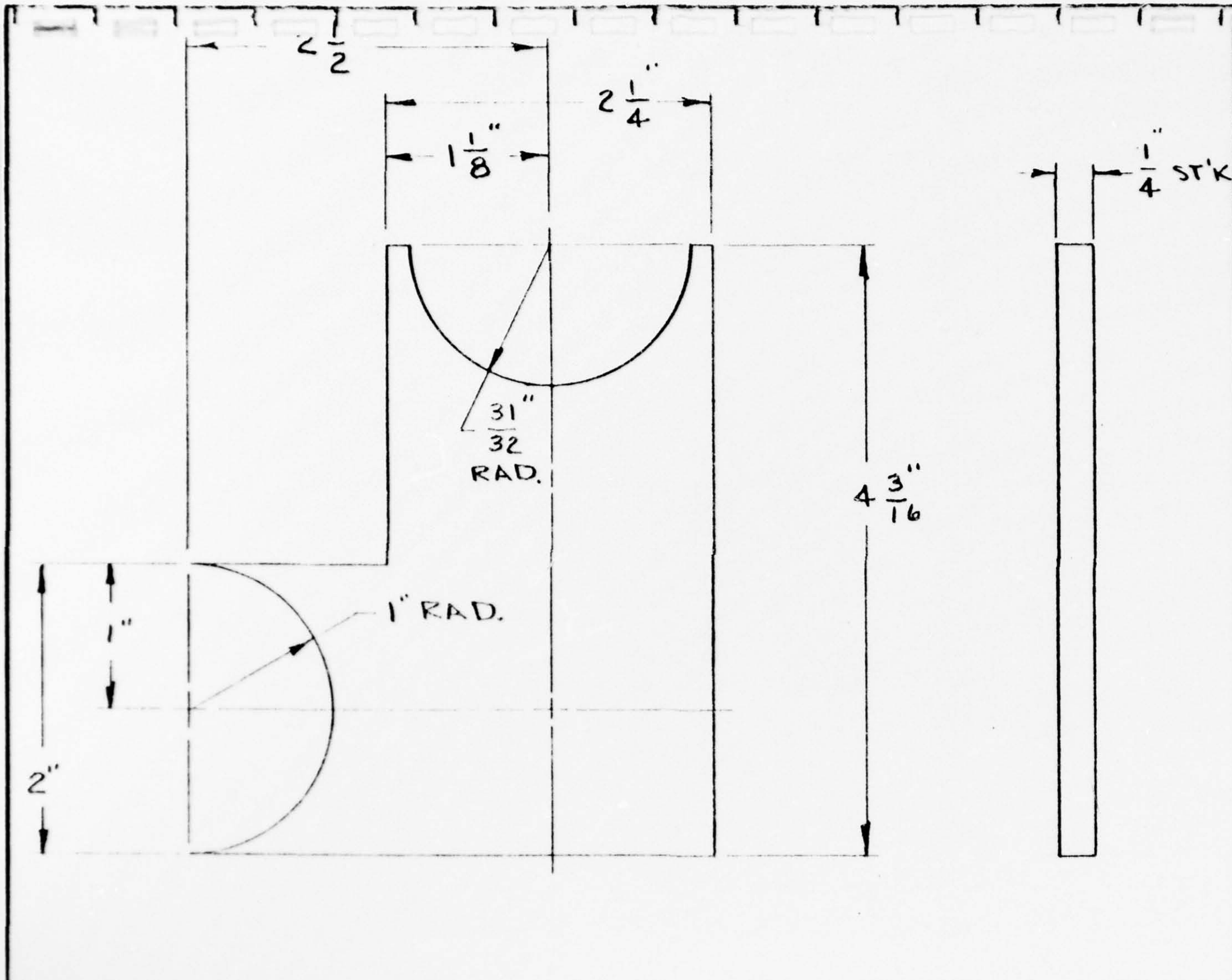
NOTES:
1. THESE JOINTS TO BE CONTINUOUS WELDS & VACUUM TIGHT
2. ITEMS 3025573 & 3025574 TO BE TACK WELDED TO 3025576
3. ITEMS 3025574 & 1 1/4" TUBING TO BE IN LINE

MATERIAL	DWG TITLE	EXHAUST MANIFOLD ASS'Y
PATTERN NO / SCALE 1:2 / USED ON	DESIGN BY	MODEL NO J15371C
RCA EQUIPMENT DEVELOPMENT	DRAWN BY R. Miles Nov 4, 1976	SIZE C DWG NO 3025572

REVISIONS — CHECKED BY — APPROVED BY — 0

STANDARD TOLERANCE — NOTE: THREADS EXTERNAL CLASS 2A, INTERNAL CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED. SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED. NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART

BRUNING 40-22 19762



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APPROVED BY

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STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED

SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART

MATERIAL: 304 STN STL (1/4" TH'K)

PATTERN NO | SCALE 1:1 | USED ON

RCA Electronic Components — EQUIPMENT DEVELOPMENT

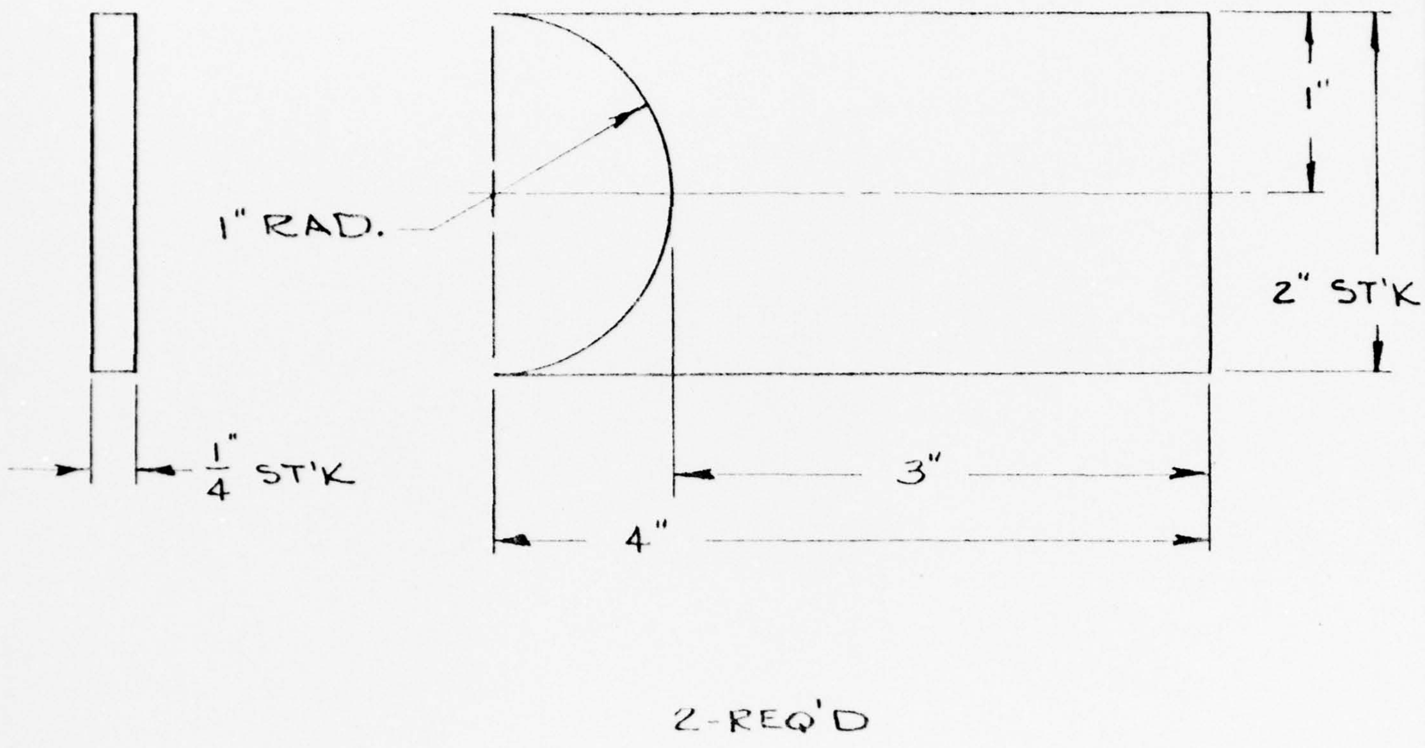
DWG. TITLE: SUPPORT

DESIGN BY

MODEL NO. J15371C

DRAWN BY: E Mik, Nov. 2, 1976

SIZE A — DWG NO 3025573



STANDARD TOLERANCE				NOTE: THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED	MATERIAL 304 STN STL 1/4 x 2"	DWG. TITLE SUPPORT
BASIC DIM		FRAC	DEC			
UP TO 6"	±	1/64	.005	SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED	PATTERN NO. / SCALE 1:1 / USED ON	DESIGN BY / MODEL NO. J15371C
ABOVE 6"	±	1/32	.010			
ABOVE 24"	±	1/16	.015	NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART	RCA Electronic Components EQUIPMENT DEVELOPMENT	DRAWN BY R. Nilson Nov. 1, 1976 / SIZE A / DWG. NO. 3025574
ANGULAR DIM ± 1/2°						

CHECKED BY

APPROVED BY

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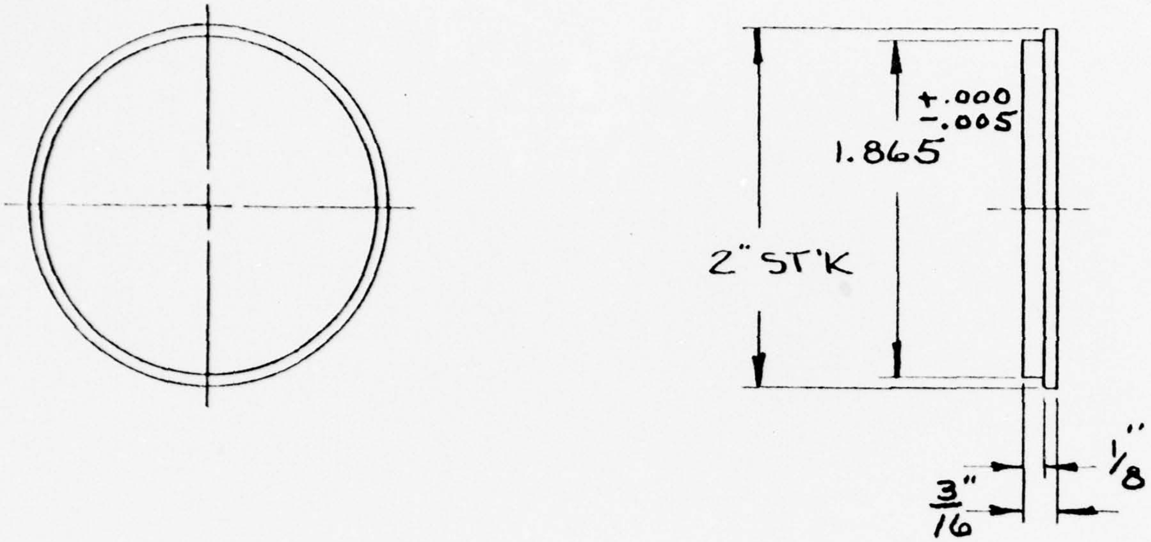


2-REQ'D

CHECKED BY

APPROVED BY

0

STANDARD TOLERANCE			
BASIC DIM		FRAC	DEC
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM ± 1/2°			

NOTE THREADS EXTERNAL, CLASS 2A, INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED

SURFACE ROUGHNESS OF 500 MICRO INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED

NOTE SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

MATERIAL 304 STN STL 2" DIA.

PATTERN NO. | SCALE 1:1 | USED ON

RCA Electronic Components EQUIPMENT DEVELOPMENT

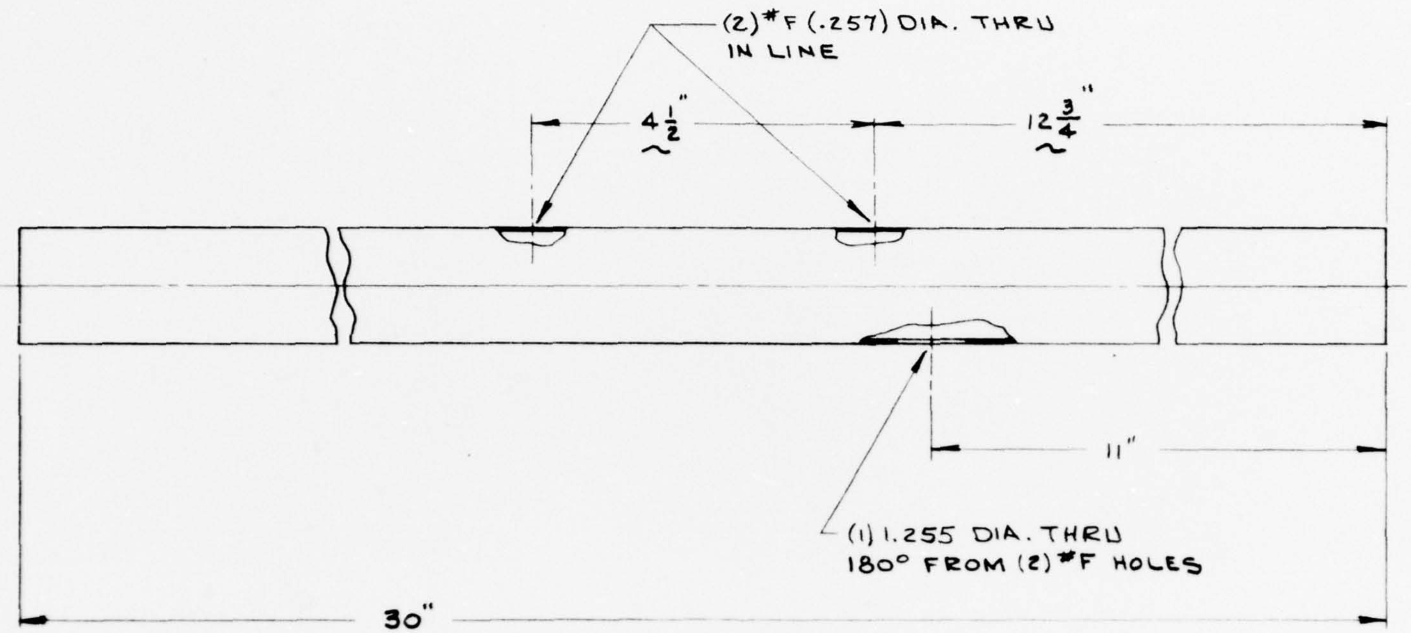
DWG. TITLE CAP

DESIGN BY

DRAWN BY R. Niles Nov. 1, 1976

MODEL NO. J15371C

SIZE A DWG. NO. 3025575



REVISIONS

CHECKED BY

APPROVED BY | 0

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STANDARD TOLERANCE			
BASIC DIM.		FRAC	DEC.
UP TO 6"	±	1/64	.005
ABOVE 6"	±	1/32	.010
ABOVE 24"	±	1/16	.015
ANGULAR DIM.	±	1/2°	

NOTE: THREADS EXTERNAL, CLASS 2A; INTERNAL, CLASS 2B (AMERICAN STDS) UNLESS OTHERWISE SPECIFIED.

SURFACE ROUGHNESS OF 500 MICRO-INCHES OR STOCK FINISH ACCEPTABLE UNLESS OTHERWISE SPECIFIED.

NOTE: SUPPLY ALL SCREWS, NUTS, BOLTS, RIVETS, WASHERS, DOWELS, TAPER PINS, COTTER PINS & WOODRUFF KEYS WITH PART.

MATERIAL 304 STN STL TUBING 2" O.D. X .065 WALL

PATTERN NO. | SCALE 1:2 | USED ON

RADIO CORPORATION OF AMERICA
EQUIPMENT DEVELOPMENT

DWG. TITLE MANIFOLD

DESIGN BY

MODEL NO. J15371C

DRAWN BY R. Miles Nov. 1, 1974

SIZE B | DWG. NO. 3025576

T 660 12/56

DEFIANCE NO. 1080F-B 470

APPENDIX C

Functional Block Diagrams for Electrical Test Equipment

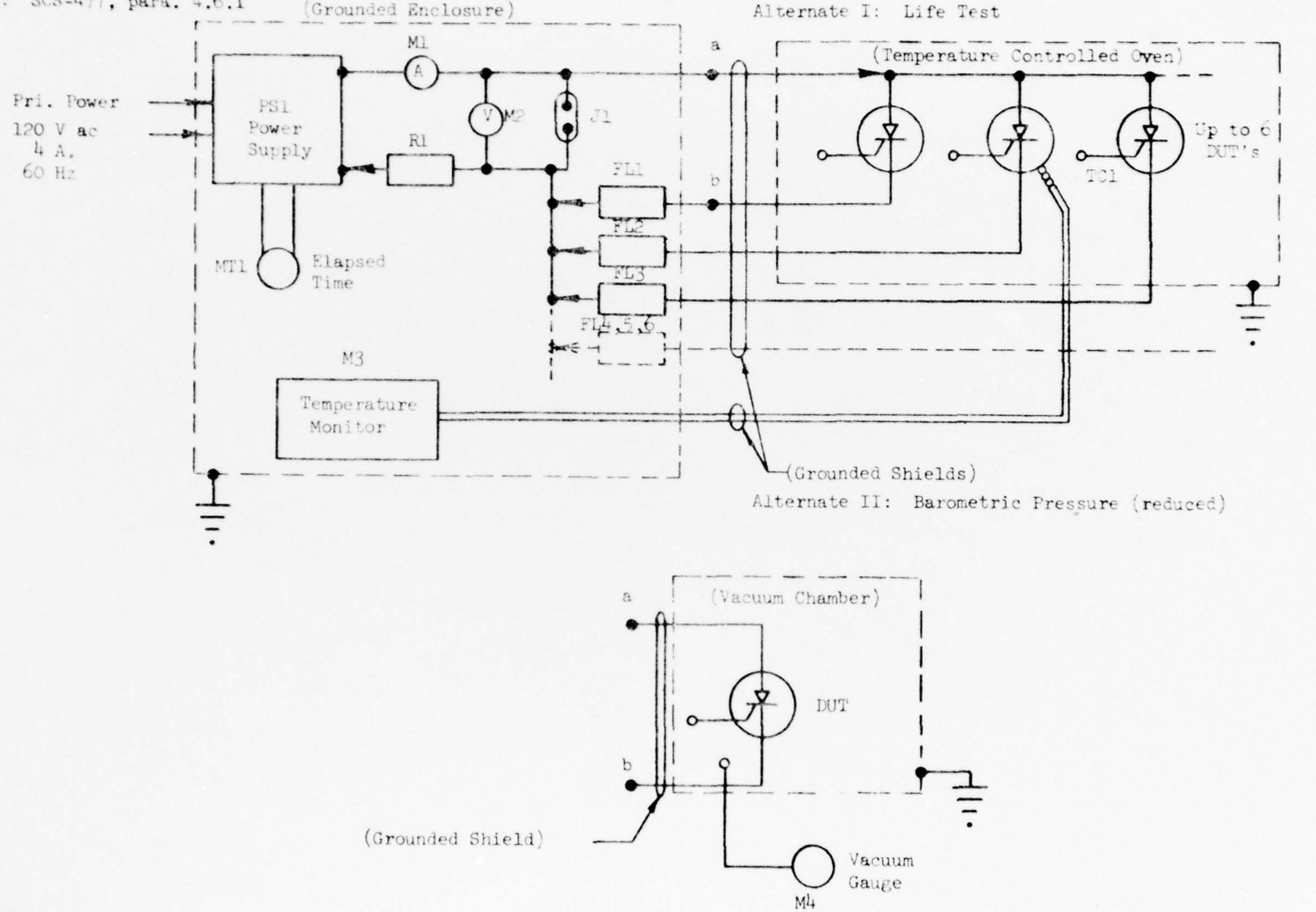
(Note: Organized in alphabetical order by Test Set title.)

Blocking Voltage Life Test/Barometric Pressure Test Set

Block Diagram

1/7/77 RER

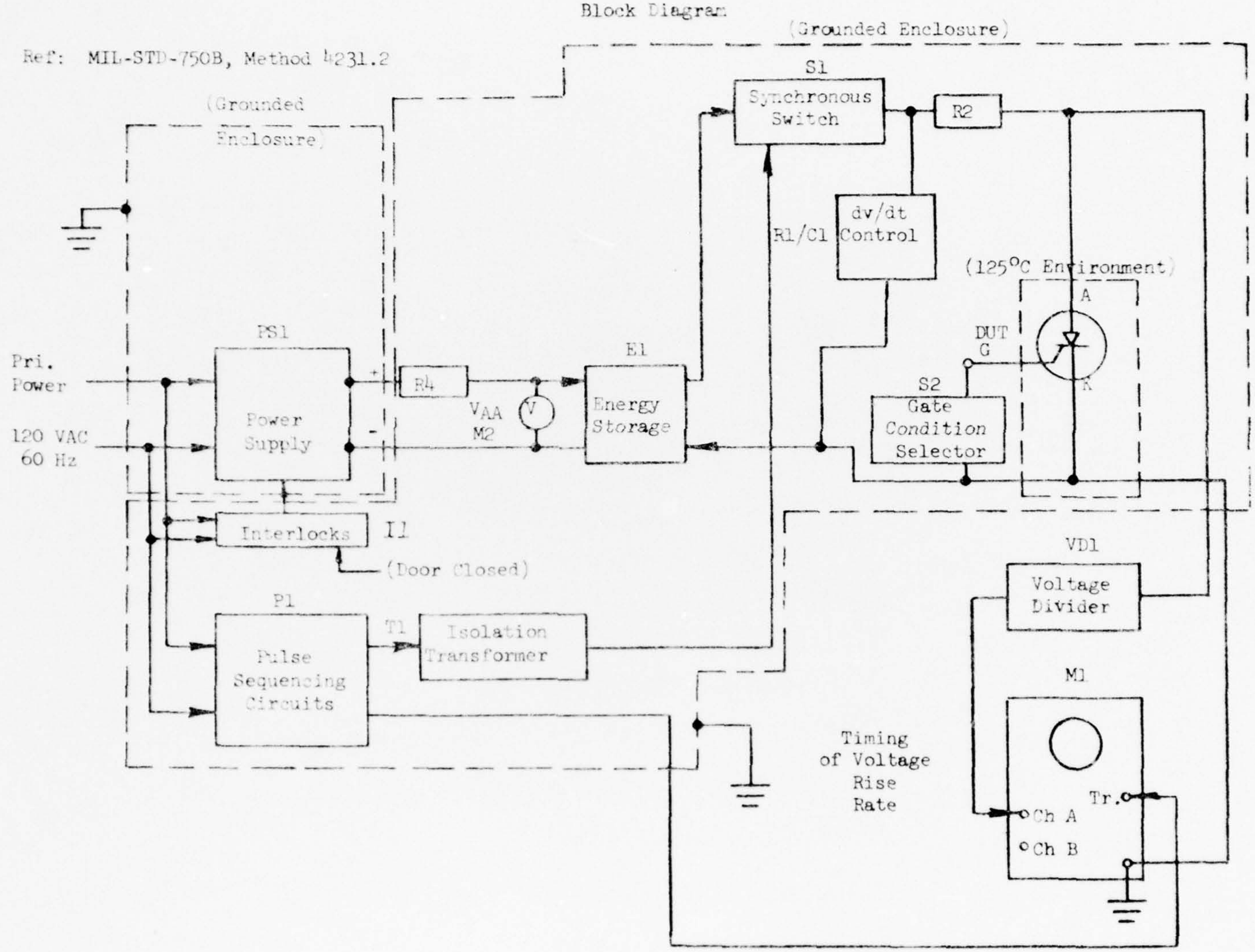
Ref: SCS-477, para. 4.6.1



Exponential Rate of Voltage Rise Test Set 1/12/77 REF

Block Diagram

Ref: MIL-STD-750B, Method 4231.2

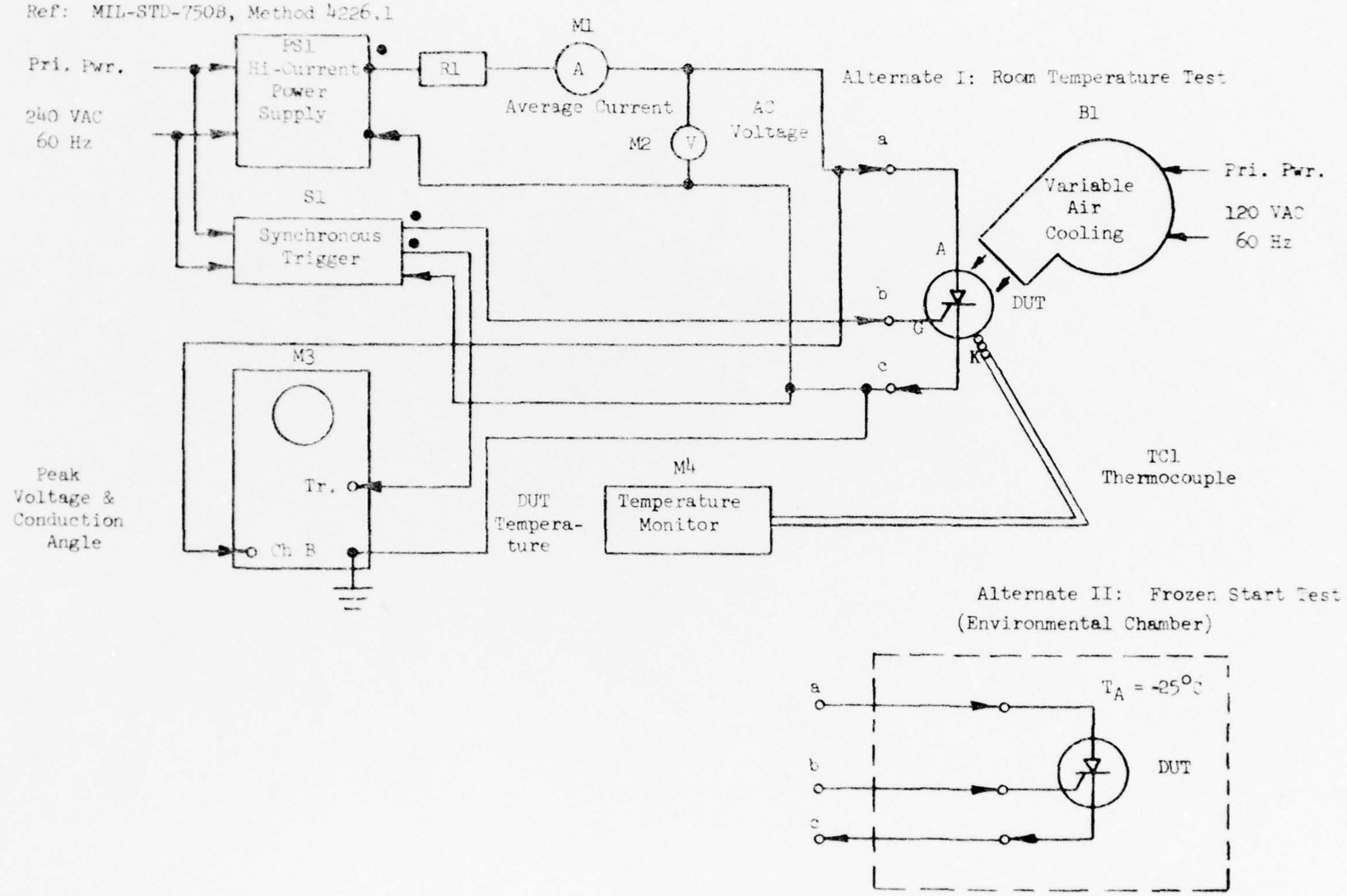


1/12/77 REB

Forward "ON" Voltage Test Set - Portable

Block Diagram

Ref: MIL-STD-750B, Method 4226.1

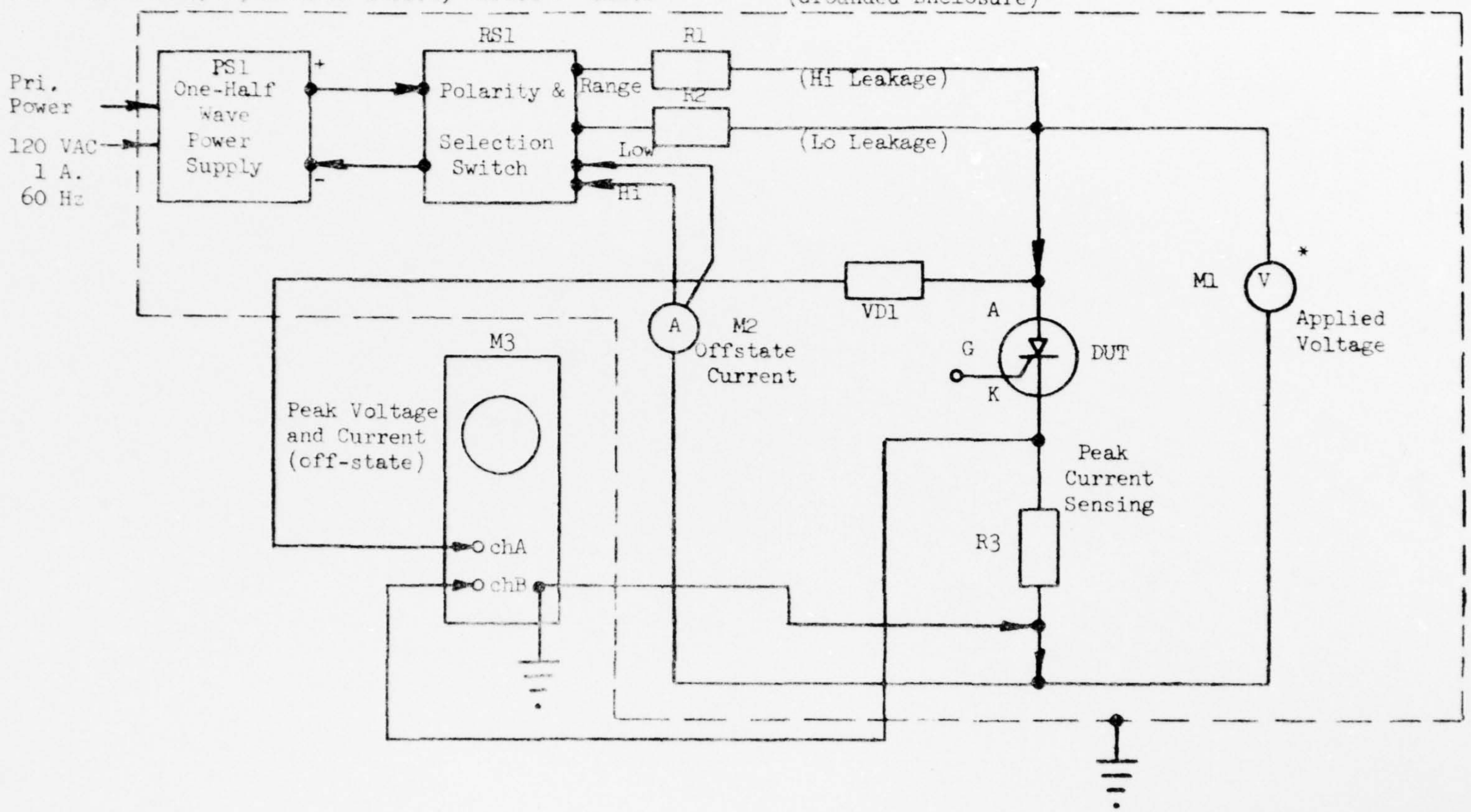


1/7/77
RER

Forward and Reverse Blocking Current Test Set - A. C. Method

Block Diagram

Ref: MIL-STD 750B, methods 1001.1, 4206.1 & 4211.1



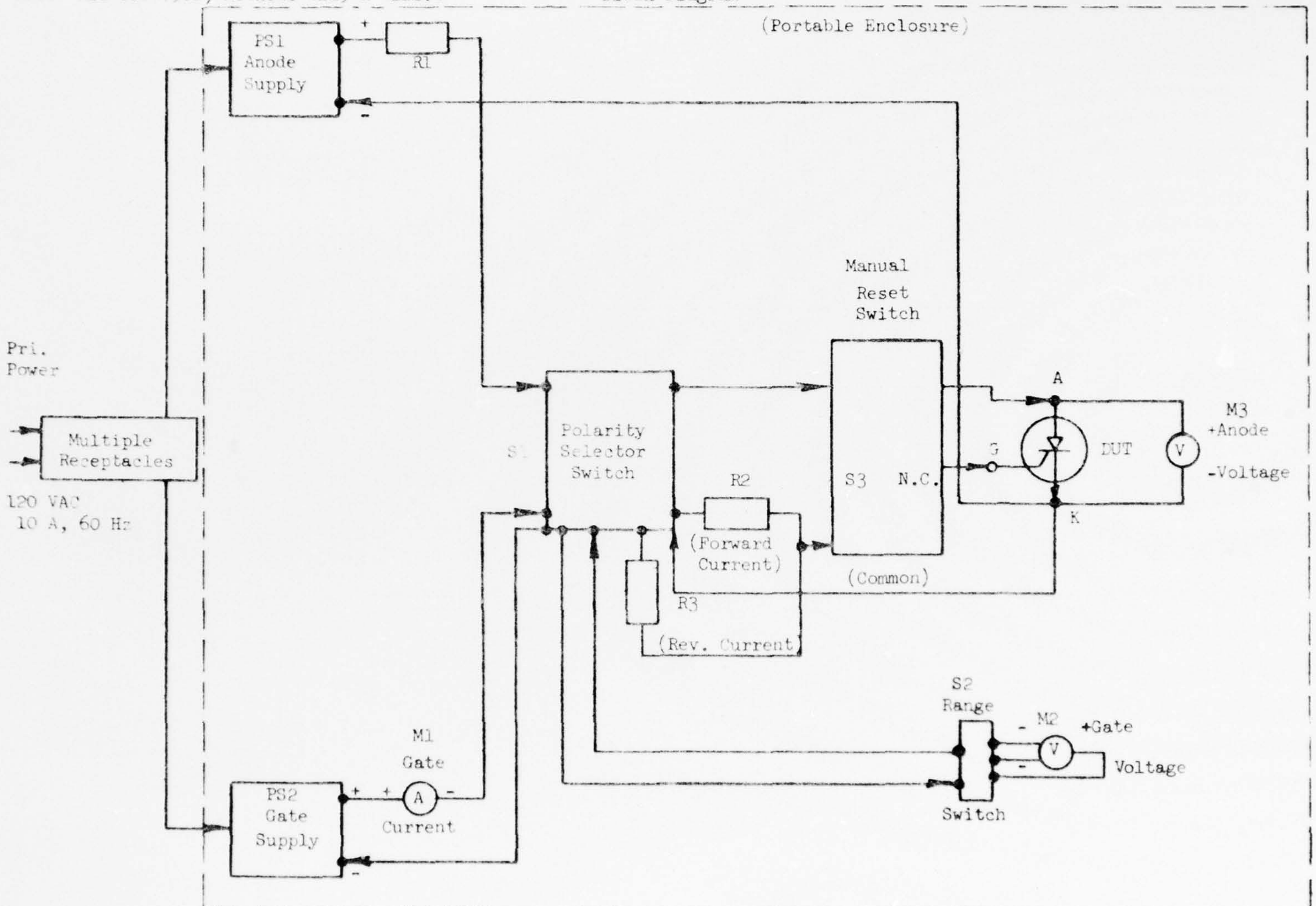
*Voltmeter polarity is also switched by RS1, but this detail was omitted to simplify the diagram.

Gate Trigger Voltage or Current Test Set - Forward & Reverse Polarity

1/7/77
RER

Ref: MIL-STD-750B, Methods 4219 & 4221.1

Block Diagram

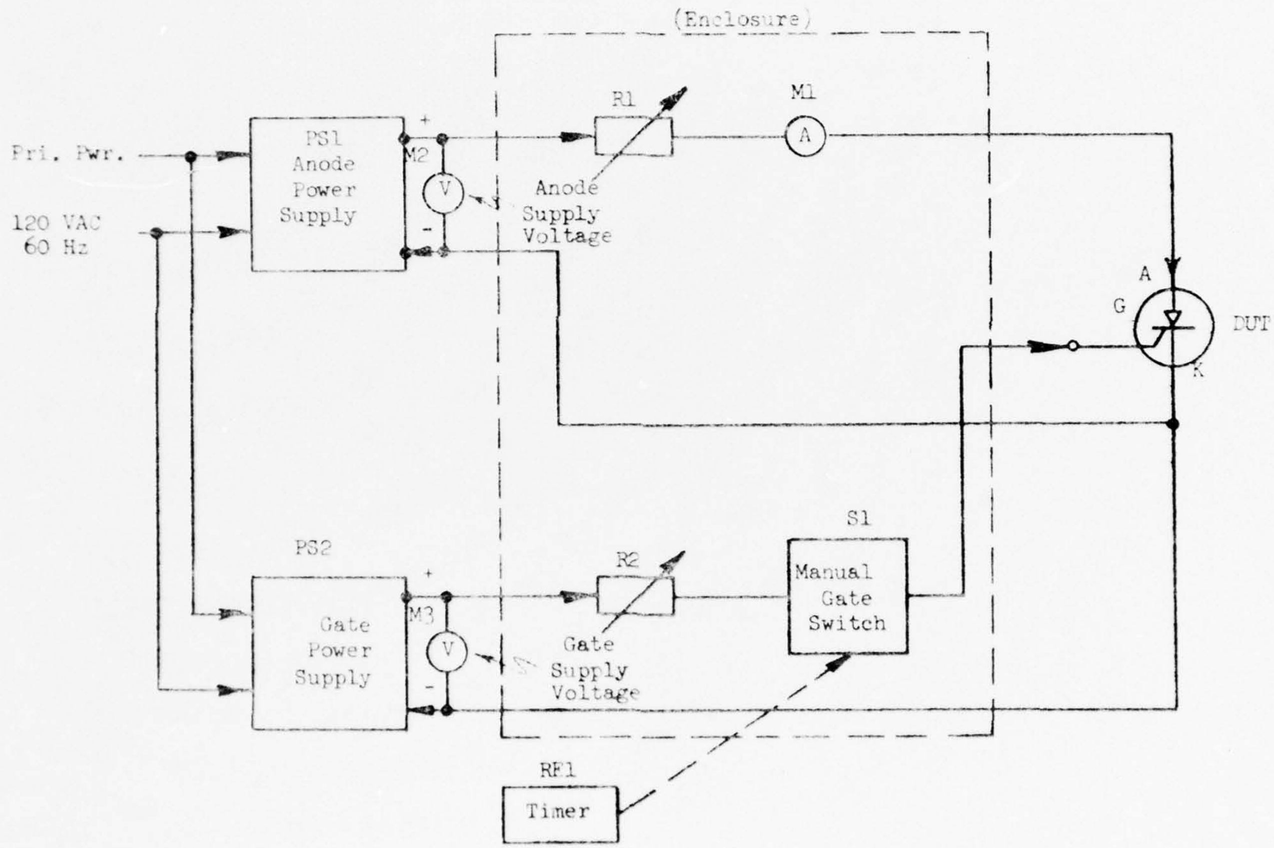


1/12/77 RER

Holding Current Test Set

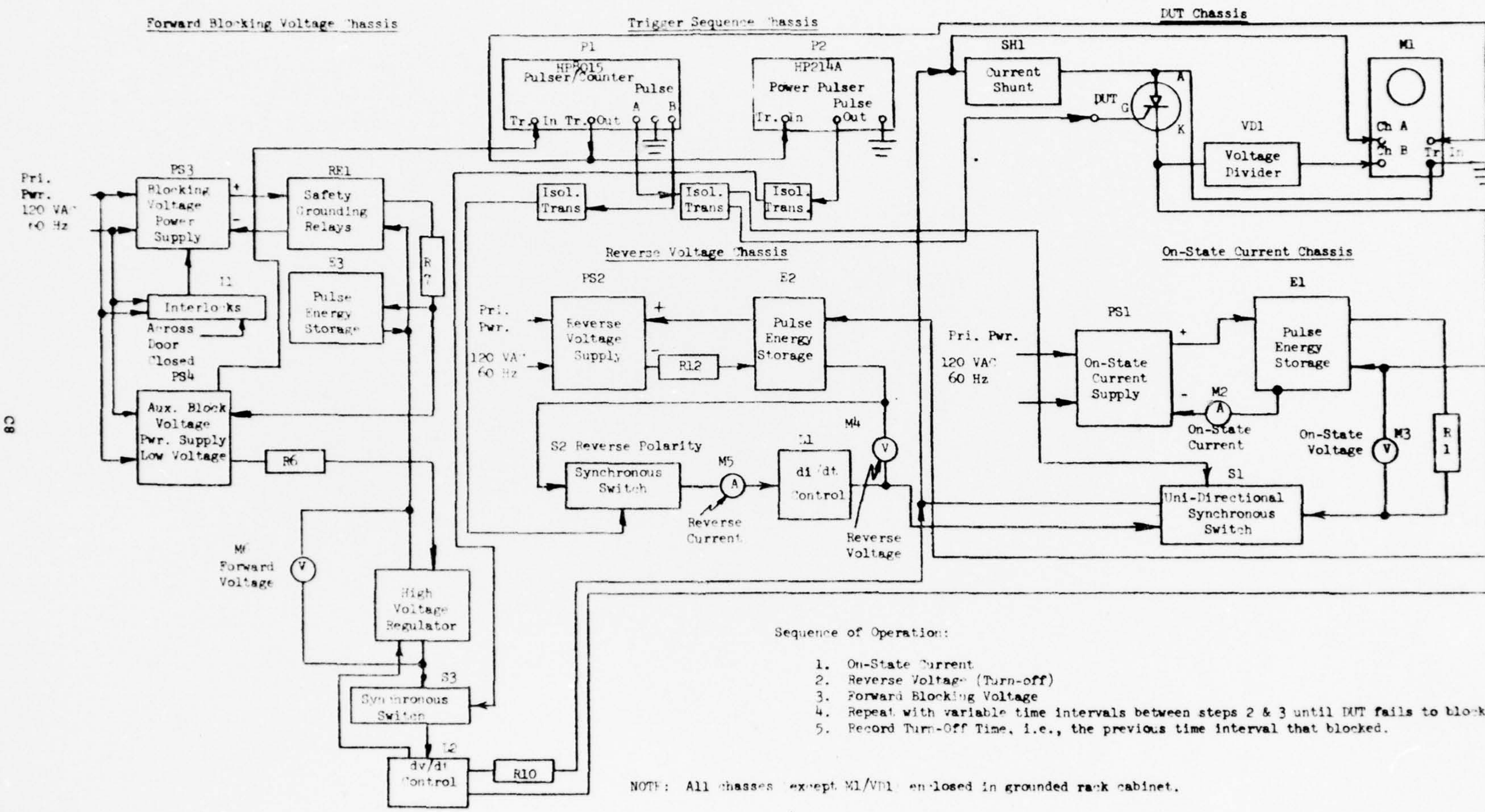
Block Diagram

Ref: MIL-STD-750B, Method 4201.2



Pulse Circuit Commutated Turn-Off Time Test Set

Functional Block Diagram



Sequence of Operation:

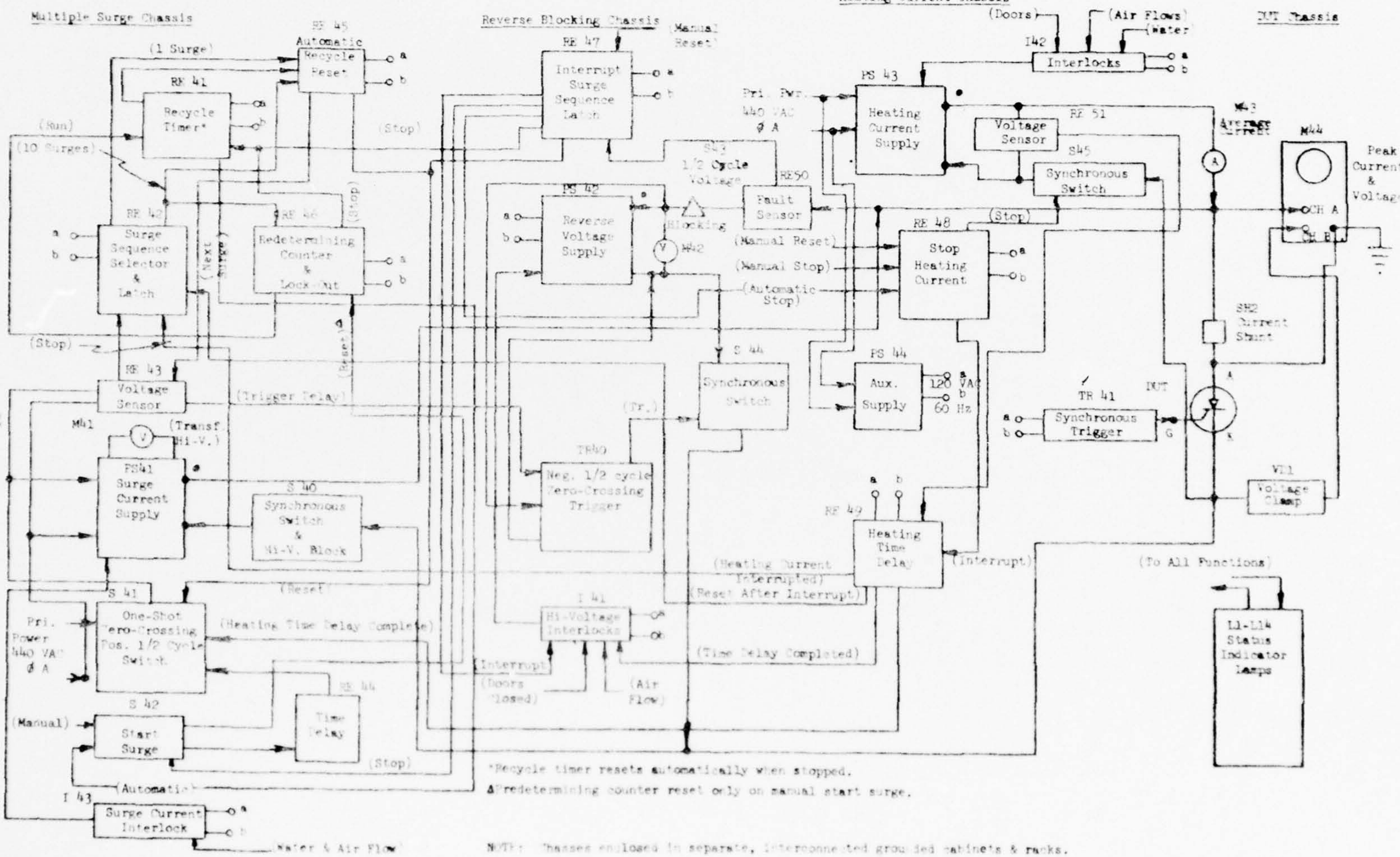
1. On-State Current
2. Reverse Voltage (Turn-off)
3. Forward Blocking Voltage
4. Repeat with variable time intervals between steps 2 & 3 until DUT fails to block.
5. Record Turn-Off Time, i.e., the previous time interval that blocked.

NOTE: All chasses (except M1/VD1) enclosed in grounded rack cabinet.

Semi-Automatic Multiple Surge Current Test Set - Reapplied Rev. Voltage

1/8/77 RER

Functional Block Diagram



*Recycle timer resets automatically when stopped.

ΔPredetermining counter reset only on manual start surge.

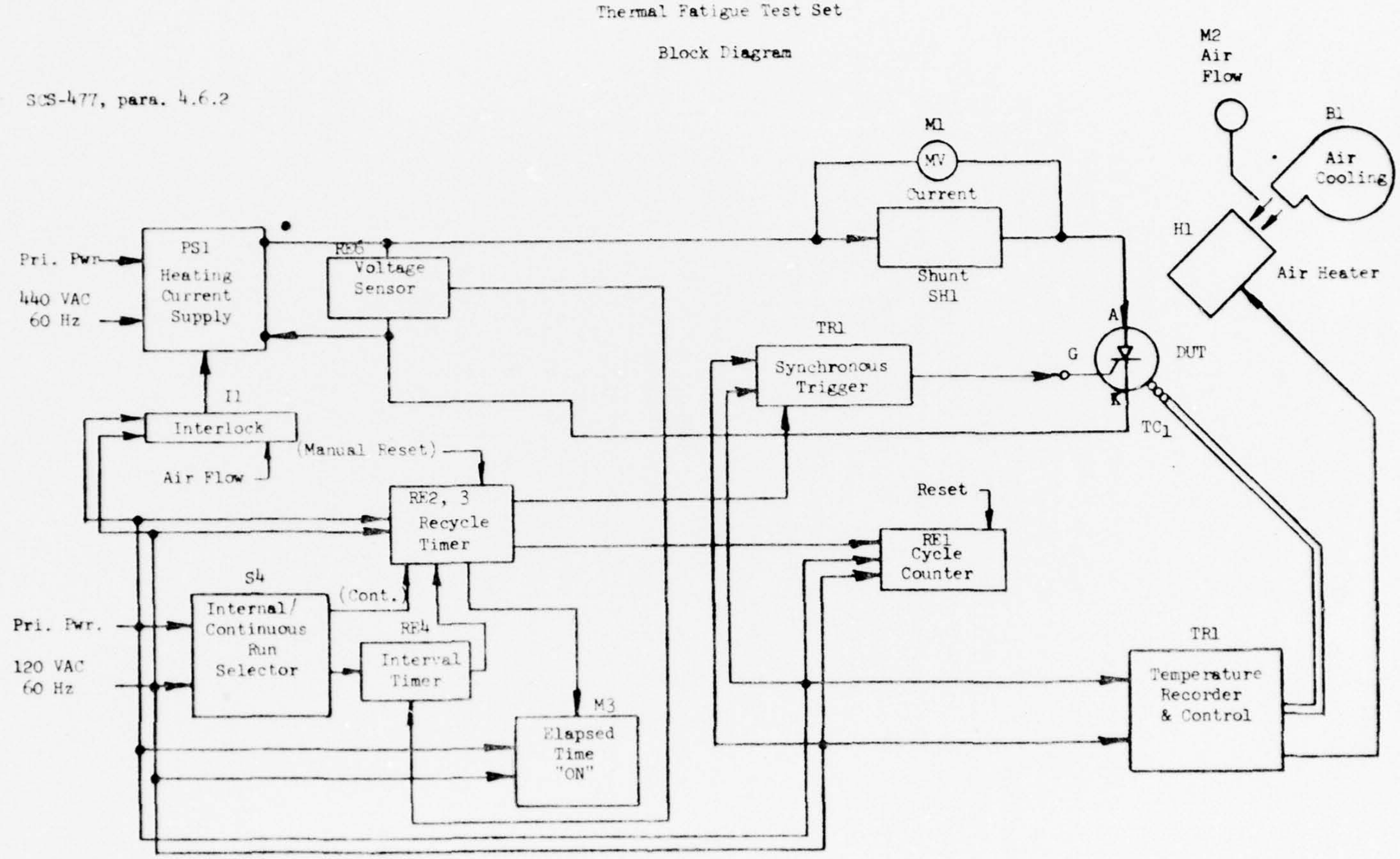
NOTE: Chasses enclosed in separate, interconnected grounded cabinets & racks.

Thermal Fatigue Test Set

Block Diagram

1/13/77 RER

Ref SCS-477, para. 4.6.2



Thermal Resistance Test Set   1/12/77 REP

Block Diagram

Ref: MIL-STD 750, Method 3151